

SECTION 600. INCIDENTAL CONSTRUCTION**DRAINAGE RELATED ITEMS****SECTION 601. PIPE DRAINS, UNDERDRAINS AND FRENCH DRAINS**

601.01 Description. This work shall consist of constructing pipe drains and pipe underdrains of the required inside diameter, and constructing french drains consisting of trenches filled with aggregate.

Pipe underdrains in backslopes shall be designated as follows:

<u>Depth of Installation</u>	<u>Type</u>
1.2 m (4 ft) or less	Backslope Drains, Type 1
Greater than 1.2 m (4 ft) not exceeding 2.4 m (8 ft)	Backslope Drains, Type 2
Greater than 2.4 m (8 ft) not exceeding 3.6 m (12 ft)	Backslope Drains, Type 3

601.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

<u>Item</u>	<u>Article/Section</u>
(a) Drain Tile	1040.01
(b) Extra Strength Clay Pipe (Note 4)	1040.02
(c) Extra Strength Perforated Clay Pipe (Note 5)	1040.02
(d) *Corrugated Steel Culvert Pipe (Note 1)	1006.01
(e) Perforated Corrugated Steel Pipe (Note 1) (Note 5)	1006.01
(f) *Bituminous Coated Corrugated Steel Culvert Pipe (Note 1)	1006.01
(g) *Corrugated Aluminum Alloy Culvert Pipe (Note 1)	1006.03
(h) Perforated Corrugated Aluminum Alloy Pipe (Note 1) (Note 5)	1006.03
(i) *Bituminous Coated Corrugated Aluminum Alloy Culvert Pipe (Note 1)	1006.03
(j) Concrete Drain Tile	1040.06
(k) *Concrete Sewer, Storm Drain and Culvert Pipe, Class 3	1040.04
(l) Perforated Polyvinyl Chloride (PVC) Pipe (Note 5)	1040.09
(m) *Polyvinyl Chloride (PVC) Pipe	1040.10
(n) Perforated Corrugated Polyethylene (PE) Tubing (Note 2) (Note 5) ..	1040.11
(o) *Corrugated Polyethylene (PE) Tubing (Note 2)	1040.12
(p) Perforated Corrugated Polyvinyl Chloride (PVC) Pipe With A Smooth Interior (Note 5)	1040.14
(q) *Corrugated Polyvinyl Chloride (PVC) Pipe With A Smooth Interior (Note 4)	1040.15
(r) Drainage Mat Underdrain (Note 3)	1040.13
(s) Perforated Corrugated Polyethylene (PE) Pipe with a Smooth Interior (Note 5)	1040.17
(t) *Corrugated Polyethylene (PE) Pipe with a Smooth Interior (Note 4)	1040.20
(u) Sand Backfill for Underdrains and Bedding	1003.04
(v) Aggregate for French Drains	1003.04, 1004.06

(w) Geotechnical Fabric for French Drains	1080.05
(x) Fabric Envelope for Pipe Underdrains	1080.01

*Pipe Drains are limited to this type material and this material will not be permitted for Pipe Underdrains.

Note 1. The thickness for steel and aluminum pipe shall be as shown in tables 1B and 1C of Article 542.03 for pipe having up to 900 mm (3 ft) of cover over the top of the pipe. The thickness for corrugated steel pipe shall be 1.32 mm (0.052 in.) for a pipe with a nominal diameter of 150 mm (6 in.) and 1.63 mm (0.064 in.) for a pipe with a nominal diameter of 200 mm (8 in.). Corrugations of 38 mm x 6.5 mm (1 1/2 in. x 1/4 in.) shall be used in lieu of 68 mm x 13 mm (2 2/3 in. x 1/2 in.) corrugations for 150 mm (6 in.) and 200 mm (8 in.) diameter pipes. The thickness for corrugated aluminum alloy pipe shall be 1.22 mm (0.048 in.) for a pipe with a nominal diameter of 150 mm (6 in.) and 1.52 mm (0.060 in.) for a pipe with a nominal diameter of 200 mm (8 in.).

Note 2. This material is limited to 100 mm (4 in.) diameter pipe when used for pipe underdrains or pipe drains.

Note 3. This material will be permitted when pipe underdrains 100 mm (4 in.) is specified.

Note 4. This material shall be used for pipe underdrains (special).

Note 5. This material shall be encased in a fabric envelope for pipe underdrains.

No open joint pipe will be allowed for pipe underdrains used under or along the edge of pavement or shoulders and for pipe drain outlets.

The Contractor may be permitted to substitute a stronger tile or pipe of the same kind of material for any tile or pipe as listed above. No extra compensation will be allowed for such substitution.

When metric pipe sizes are specified the next larger manufactured size may be substituted at no extra cost to the Department.

CONSTRUCTION REQUIREMENTS

601.03 Pipe Drain Installation. Pipe Drains shall be installed at the locations shown on the plans or as directed by the Engineer. The pipe shall be bedded in the underlying material to a depth not less than ten percent of the external diameter of the pipe and, where trenching is required, the trench shall have a width of not less than the external diameter of the pipe plus 450 mm (18 in.). The bottom of the trench shall be compacted in a manner meeting the approval of the Engineer.

Joints and fittings may be assembled without gaskets or solvent cement if the joint is hand tight and the spigot enters the socket not less than 1/3 of the socket depth for solvent cement joints and full-depth for elastomeric gasket joints.

No pipe shall be placed in the trench until it and the prepared foundation have been approved by the Engineer. The pipe shall be laid so that the flow line will be at the grade shown on the plans or established by the Engineer. The permissible minimum cover over a pipe shall be 150 mm (6 in.).

Laying of pipes shall commence at the outlet end and proceed toward the inlet end with the pipes true to line and grade.

The ends of the pipe shall be carefully cleaned before they are placed, and shall be placed to avoid unnecessary handling on the foundation. As each length of pipe is laid, the ends of the pipe shall be protected to prevent the entrance of any material.

Longitudinal laps shall be placed at the sides and separate sections of pipe shall be joined with tightly drawn, approved connecting bands.

The trench shall be backfilled with select material, meeting the approval of the Engineer, placed in 200 mm (8 in.) layers, loose measurement, and compacted to the Engineer's satisfaction.

Material excavated from the trench, if it meets the approval of the Engineer, may be used for backfill.

601.04 Pipe Underdrain Installation.

- (a) General. Pipe underdrains placed along pavement edges shall be outletted across the shoulder to the ditch approximately every 150 m (500 ft) and at all low points in the flow line of the underdrain. Pipe underdrains may be outletted into the cross road culvert when the fill above the culvert is 1.5 m (5 ft) or less. Pipe underdrains shall be outletted using Pipe Underdrain (Special) according to the details shown on the plans.

When pipe underdrains are included in contracts involving pavement patching, the pipe underdrains shall be installed after patching operations.

When installing pipe underdrains on contracts with existing shoulders and it is determined by the Engineer that the Contractor's equipment or method of excavation is causing the material under the pavement to become dislodged, the Contractor shall move the location of the trench laterally away from the pavement a sufficient distance so that edge sluffing will not occur under the pavement. No additional compensation will be allowed the Contractor for any increases in cost or quantities of backfill material that may be caused by a change in the location of the pipe underdrain trench.

On contracts where existing shoulders are to be resurfaced, the trench of the pipe underdrain and pipe underdrain (special) shall be backfilled with FA1 or FA2 to within 125 mm (5 in.) of the surface of the existing shoulder. The top 125 mm (5 in.) of the trench shall be backfilled with a bituminous

aggregate mixture meeting the requirements of Section 482 and compacted to a density of not less than 90 percent of the theoretical density.

On contracts where the existing shoulders are not being resurfaced, the trench of the pipe underdrain and pipe underdrain (special) shall be backfilled with FA 1 or FA 2 to within 200 mm (8 in.) of the surface of the existing shoulder. The top 200 mm (8 in.) of the trench shall be backfilled with a bituminous aggregate mixture according to Section 482 and compacted to a density of not less than 90 percent of the theoretical density.

Perforated pipe shall be placed with the perforations down and the pipe sections shall be joined securely with the appropriate coupling fittings or bands.

Non-perforated pipe with bell ends shall be laid with the bell end upgrade and with open joints wrapped with suitable material to permit entry of water or unwrapped as specified. Upgrade ends of all pipe installations shall be closed with suitable plugs to prevent entry of soil materials.

No equipment shall be operated directly upon the completed pipe installation for longitudinal underdrains constructed along the edges of pavement or subbase.

- (b) Perforated Corrugated Polyethylene (PE) Tubing. Trenches shall be excavated to the dimensions and grades required by the plans or as directed by the Engineer. In no case, shall the diameter of the 180 degree semicircular bedding groove exceed the outside diameter of the plastic tubing and fabric envelope by more than 6 mm (1/4 in.) and in no case, shall the width of trench exceed 250 mm (10 in.). The trench bottom outside the limits of the bedding groove shall be undisturbed and free of loose material.

The excavation of the trench and 180 degree semicircular bedding groove and the placement of the underdrain tubing shall be accomplished in a single continuous operation. The underdrain tubing shall be laid true to grade and shall not be stretched more than five percent during installation. The underdrain tubing shall be seated in the bedding groove and held firmly in place by mechanical means while sand backfill is placed and compacted to a height of 125 mm (5 in.) \pm 25 mm (1 in.) above the tubing. After the first lift is compacted, the remainder of the sand backfill shall be placed and compacted. Placement and compaction of the remainder of the backfill may be included in the same pass as the excavation of the trench and bedding groove and the placement of the tubing. When approved by the Engineer, placement and compaction of the two lifts of backfill may be accomplished in a separate operation closely following the trenching and tubing placement. The maximum distance between the two operations shall be the greater of 150 m (500 ft) or the distance trenched in 15 minutes. The distance shall be further limited as necessary to assure the tubing remains firmly seated in the bedding groove with no loose material from the trenching or other operation under or alongside the tubing. Sloughing of the trench wall shall be prevented. The minimum density of the compacted backfill shall be 90 percent of the standard laboratory density determined in accordance with AASHTO T 99 (Method A).

- (c) **Drainage Mat Underdrain.** When drainage mat underdrain is being installed in lieu of 100 mm (4 in.) diameter underdrain, trench shall be excavated to the dimensions and grade required by the plans or as directed by the Engineer.

Drainage mat underdrain shall be placed against the shoulder side of the trench without damaging the core or tearing the fabric and held firmly in place while FA1 or FA2 is placed and compacted to a height of 150 mm (6 in.) \pm 25 mm (1 in.). After the first lift is compacted by a vibratory wheel or plate compactor with a rated impact force of approximately 22 kN (5000 lb), the remainder of the backfill shall be placed and compacted by a vibratory compactor to the satisfaction of the Engineer.

Each length of drainage mat underdrain shall be joined to the adjacent length prior to installation. Splices shall keep the adjoining mats in proper alignment, not separate during installation, have the same or better compressive strength than the mat and be sealed against infiltration of backfill material.

- (d) **Pipe Underdrains Other Than PE Tubing and Drainage Mat.** When the pipe for the underdrain is other than corrugated polyethylene (PE) tubing or drainage mat underdrain, the trenches shall be excavated to the dimensions and grade shown on the plans or as directed by the Engineer, and a 25 mm (1 in.) layer of bedding material shall be placed and compacted in the bottom of the trench extending upward under the haunches to 1/2 the depth of the pipe underdrain for the full width and length of trench.

The pipe being used for the pipe underdrain shall be embedded firmly in the bedding material.

After the pipe installation has been inspected and approved, granular backfill shall be placed and compacted to a height of 300 mm (12 in.) above the top of pipe. Displacement of the pipe or the covering at open joints shall be prevented. The remainder of the granular backfill material shall then be placed and compacted to the required height. Any remaining portion of the trench above the granular backfill shall be filled with granular or impervious material as specified and thoroughly compacted.

- (e) **Pipe Underdrains (Special).** Pipe underdrain (special) used for outletting pipe underdrains shall conform to the trench requirements for pipe underdrains.

The portion of the pipe underdrain (special) under the paved shoulder shall be backfilled with sand as specified for pipe underdrains. The remaining portion shall be backfilled with select material meeting the approval of the Engineer.

601.05 Concrete Headwalls. Concrete headwalls for pipe drains, pipe underdrains (special) and backslope drains shall be constructed at the locations and according to the details shown on the plans. The headwalls shall be either cast-in-place of Class SI Concrete according to the applicable portions of Section 503, or

shall be precast of Class PC Concrete [28,000 kPa (4000 psi) after 28 days] according to the applicable portions of Section 504. If a precast unit is used, the pipe shall be grouted and sealed to the headwall opening with a cement mortar.

The headwalls shall be placed so that there is a six percent minimum slope on the invert. The uppermost point of the headwall shall be placed flush with the roadway slope. The earth side slopes adjacent to the headwall shall then be shaped to conform to the sides and toe of the headwall.

The outlet end of the pipe shall be protected by a permanent rodent shield, upon placement of the pipe drain, pipe underdrain (special) or backslope drain.

The rodent shield shall have the configuration shown on the plans and shall be constructed of the hot dip galvanized steel industrial wire cloth. The cloth size shall be 125 mm x 175 mm (5 in. x 7 in.) minimum before fabrication of shield for 100 mm (4 in.) pipe. Other submitted designs for a removable rodent shield may be used with the approval of the Engineer.

601.06 French Drains. French drains shall be constructed at the locations and to the dimensions shown on plans or as directed by the Engineer.

The trench shall be excavated to the required width and depth, leveled, and smoothed to the satisfaction of the Engineer prior to filling with aggregate. The specified gradation of fine or coarse aggregate shall then be placed to the required depth and covered with the next specified layer of material.

When the use of geotechnical fabric is specified for lining the trench, the fabric shall be delivered to the jobsite in such a manner to facilitate handling and incorporation into the work without damage. In no case shall the fabric be stored and exposed to direct sunlight that might significantly diminish its strength or toughness. Torn or punctured fabric shall not be used.

After the trench has been approved by the Engineer, the fabric shall be loosely rolled out so the center of the fabric is at the centerline of the excavated trench, and it will not tear when the aggregate is placed. When more than one section of fabric is used, the fabric shall overlap a minimum of 600 mm (2 ft). Enough fabric shall remain uncovered after the trench is filled to provide for fabric overlap at the top.

During backfilling with angular aggregates, a minimum 150 mm (6 in.) cushion of the aggregate shall be carefully placed over the lined trench before end dumping larger aggregates out of trucks or other equipment. Following the backfilling operation, the fabric shall be lapped over the top and covered with the next specified material.

601.07 Method of Measurement. Pipe drains, pipe underdrains, pipe underdrains (special) and backslope drains will be measured for payment in meters (feet), in place. The measured quantities of drainage mat underdrain will be included in the measured quantities of Pipe Underdrain, 100 mm (4 in.).

Measurement for pipe underdrain (special) will be made from the back of the headwall to the centerline of the longitudinal pipe underdrain. At any location where, due to the type of longitudinal pipe underdrain material being used, more than one

pipe underdrain (special) is required, only one run of pipe underdrain (special) will be measured for payment.

Aggregate used for french drains will be measured for payment in metric tons (tons) or in cubic meters (cubic yards) according to Article 311.08.

Geotechnical fabric for french drains will be measured for payment in place and the area computed in square meters (square yards). The additional fabric required for overlaps of individual sheets and overlaps at the top of the french drain will not be measured for payment.

When pipe underdrains are included on contracts with existing paved shoulders, shoulder removal and replacement over the trench area, as specified in Article 601.04 (a) will be measured for payment in place in meters (feet) along the pipe underdrain and the portion of the pipe underdrain (special) that is under the paved shoulder.

601.08 Basis of Payment. Pipe drains, underdrains, and backslope drains will be paid for at the contract unit price per meter (foot) for PIPE DRAINS; PIPE UNDERDRAINS; PIPE UNDERDRAINS (SPECIAL); BACKSLOPE DRAINS, TYPE 1; BACKSLOPE DRAINS, TYPE 2; or BACKSLOPE DRAINS, TYPE 3; of the diameter specified, or of the kind of material and diameter specified.

Concrete headwalls for pipe drains, pipe underdrains (special) and backslope drains will be paid for at the contract unit price each for CONCRETE HEADWALLS FOR PIPE DRAINS.

When pipe underdrains are installed through existing paved shoulders, removing and replacing the existing paved shoulder will be paid for at the contract unit price per meter (foot) for SHOULDER REMOVAL AND REPLACEMENT, of the thickness specified, which price shall include furnishing, placing and compacting the bituminous aggregate mixture.

French drains will be paid for at the contract unit price per metric ton (ton) or cubic meter (cubic yard) for FRENCH DRAINS, which price shall include furnishing and placing the required backfill material, all excavation except rock and that required for the removal of unstable or unsuitable material, and for disposing of surplus materials excavated from the trench.

Geotechnical fabric, when required for french drains, will be paid for at the contract unit price per square meter (square yard) for GEOTECHNICAL FABRIC FOR FRENCH DRAINS.

Removal and replacement of unstable or unsuitable material will be paid for according to Article 109.04.

Excavation in rock will be paid for according to Section 502 for Rock Excavation for Structures.

SECTION 602. CATCH BASIN, MANHOLE, INLET, DRAINAGE STRUCTURES AND VALVE VAULT CONSTRUCTION, ADJUSTMENT AND RECONSTRUCTION

602.01 Description. This work shall consist of constructing, adjusting, or reconstructing catch basins, manholes, inlets, or valve vaults, with frames and grates or lids, and constructing drainage structures with frames and grates.

602.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Brick	1041
(c) Concrete Masonry Units	1042
(d) Gray Iron Castings	1006.14
(e) Precast Reinforced Concrete Manhole Sections	1043
(f) Ductile Iron Castings	1006.15
(g) Structural Steel	1006.04
(h) External Sealing Band	1057
(i) Mastic Joint Sealer	1056
(j) Reinforcement Bars and Fabric	1006.10

Note: Inlet and outlet tile or pipe shall be of the same size and kind, and shall meet the same requirements as the tile or pipe with which they are connected.

602.03 Classification. Classification as to adjustment or reconstruction shall be on the following basis:

- (a) Adjustment. This classification shall include all those existing catch basins, manholes, inlets and valve vaults which are to be adjusted to grade where 600 mm (2 ft) or less of masonry will be either added, removed or rebuilt to bring the specified casting to the finished grade of the proposed improvement.
- (b) Reconstruction. This classification shall include all those existing catch basins, manholes, inlets and valve vaults which must be reconstructed or which are to be adjusted to grade where more than 600 mm (2 ft) of masonry will be either added, removed, or rebuilt to bring the specified casting to the finished grade of the proposed improvement.

CONSTRUCTION REQUIREMENTS

602.04 Concrete. Cast-in-place concrete shall be constructed of Class SI Concrete according to the applicable portions of Section 503. Precast concrete units shall be constructed of Class PC Concrete according to the applicable portions of Section 504, except shop drawings will not be required.

Mortar shall be composed of one part masonry cement to three parts sand, by volume, based on dry materials. Mortar which has been mixed longer than 30 minutes or which has developed its initial set shall not be used.

Bottom concrete slabs shall be reinforced by either reinforcement bars or welded wire fabric. The minimum reinforcement shall be 975 sq mm/m (0.46 sq in./ft) in both directions.

602.05 Brick Masonry. Brick masonry shall be constructed in horizontal courses with a running bond using a header course every sixth course, or any standard bond of equivalent strength. The brick shall be laid in mortar.

602.06 Concrete Masonry Units. Concrete masonry units shall be constructed in horizontal courses with vertical joints broken. The units shall be laid in mortar.

602.07 Precast Reinforced Concrete Sections. Precast reinforced concrete sections shall be constructed in horizontal courses. The units shall be laid in mortar, sealed with external sealing bands, or sealed using mastic joint sealer. When mastic joint sealer is used, the material shall completely fill the joint after the units have been brought together. All precast units shall be installed on a 75 mm (3 in.) thick sand cushion of FA1 or FA2 according to Article 1003.01.

602.08 Steps. Steps, when required, shall be of cast gray iron conforming to the contract. Steps shall be embedded into the wall a minimum of 75 mm (3 in.) but shall not be extended on the outside of the structure. Steps of other design and material that conform to the minimum requirements shown on the plans may be used when approved by the Engineer.

602.09 Wooden Baffles. Wooden baffles, when required for drainage structures, shall be constructed of pine, fir, spruce, larch, or cedar No. 4 common board (utility), S4S, untreated.

602.10 Furnishing and Placing Castings.

- (a) **Furnishing.** When specified, new castings, including frames, grates and lids, shall be according to Article 604.03.
- (b) **Placing for Rigid Pavements.** Castings placed on concrete or masonry surfaces shall be set in full mortar beds. Castings shall be set to the finished pavement elevation so no subsequent adjustment will be necessary. Lifting devices will be approved by the Engineer.
- (c) **Placing for Flexible Pavements.** The structures shall be constructed or adjusted to an elevation which will match the cross section of the subgrade.

After the base course and binder course have been placed, and prior to placing the surface course where there is no binder course, the structures shall be adjusted to grade by removing the binder and base course adjacent to and for a distance not exceeding 300 mm (12 in.) outside the base of the castings. After the structures have been adjusted, the castings shall be set in full mortar beds. Castings shall be set to the finished pavement elevation

so that no subsequent adjustment will be necessary, and the space around the casting shall be filled with Class SI Concrete, or a bituminous concrete surface or binder course material to the elevation of the surface of the base course or binder course. If Class SI Concrete is used, it shall be cured for a period of 72 hours. If surface or binder course material is used, it shall be placed in 75 mm (3 in.) layers at the temperature requirements for the placing of surface or binder course and compacted with a pneumatic tamper.

602.11 Excavation and Backfilling. In order to permit the joints to be mortared properly and to permit proper compaction of the backfill material, the excavation shall be made to a diameter of at least 150 mm (6 in.) greater than the diameter of the structure.

The space between the sides of the excavation and the outer surfaces of the catch basin, manhole, inlet or valve vault shall be backfilled with sand or stone screenings, when these structures are in the subgrade or if the nearest point of the excavation for these structures falls within 600 mm (2 ft) of the pavement edge. When the structure falls beyond these limits, other backfilling material may be used with the approval of the Engineer.

The backfill shall be compacted according to Article 550.07.

602.12 Inlet and Outlet Pipes. Pipe or tile placed in the masonry for inlet or outlet connections shall extend through the walls and beyond the outside surfaces of the walls a sufficient distance to allow for connections, and the masonry shall be carefully constructed around them so as to prevent leakage along the outer surfaces.

602.13 Curing and Protection. After the masonry work is completed, it shall be kept moist and protected from the elements for a period of not less than 48 hours.

602.14 Cleaning. All catch basins, manholes, inlets, and similar structures newly constructed, adjusted or reconstructed under the contract, shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection.

602.15 Basis of Payment. When new construction is specified, this work will be paid for at the contract unit price each for CATCH BASINS, MANHOLES, INLETS, DRAINAGE STRUCTURES, or VALVE VAULTS, of the type or type and diameter specified, and with the type of frame and grate or frame and lid specified or median inlet number specified, which price shall include all frames, grates, lids, concrete and reinforcement for aprons for median inlets, sand cushion, steps and flat slab tops, and all excavation and backfilling, except excavation in rock.

When adjustment or reconstruction is specified and existing frames, grates and lids are to be used, this work will be paid for at the contract unit price each for CATCH BASINS TO BE ADJUSTED, CATCH BASINS TO BE RECONSTRUCTED, MANHOLES TO BE ADJUSTED, MANHOLES TO BE RECONSTRUCTED, INLETS TO BE ADJUSTED, INLETS TO BE RECONSTRUCTED, VALVE VAULTS TO BE ADJUSTED, or VALVE VAULTS TO BE RECONSTRUCTED, which price shall include resetting the frame with grate or lid, and excavation and backfill, except excavation in rock.

When adjustment or reconstruction is specified and new frames, grates, lids or median inlets are to be used, this work will be paid for at the contract unit price each for CATCH BASINS TO BE ADJUSTED WITH NEW FRAME AND GRATE or LID, of the type specified, or WITH NEW MEDIAN INLET, of the number specified; CATCH BASINS TO BE RECONSTRUCTED WITH NEW FRAME AND GRATE or LID of the type specified, or WITH NEW MEDIAN INLET of the number specified; MANHOLES TO BE ADJUSTED WITH NEW FRAME AND GRATE or LID of the type specified, or WITH NEW MEDIAN INLET of the number specified; MANHOLES TO BE RECONSTRUCTED WITH NEW FRAME AND GRATE or LID of the type specified, or WITH NEW MEDIAN INLET of the number specified; INLETS TO BE ADJUSTED WITH NEW FRAME AND GRATE or LID of the type specified, or WITH NEW MEDIAN INLET of the number specified; INLETS TO BE RECONSTRUCTED WITH NEW FRAME AND GRATE or LID of the type specified, or WITH NEW MEDIAN INLET of the number specified; VALVE VAULTS TO BE ADJUSTED WITH NEW FRAME AND CLOSED LID of the type specified; or VALVE VAULTS TO BE RECONSTRUCTED WITH NEW FRAME AND CLOSED LID of the type specified; which price shall include all materials, including frames, grates, lids, concrete and reinforcement for aprons for median inlets, and the sand cushion, steps and flat slab tops, when required, and all excavation and backfilling, except excavation in rock.

Additional reinforcement, when required for Type 15 Frames and Lids, will be included in the unit bid price of the type of structure specified.

Excavation in rock will be paid for according to Section 502 for Rock Excavation for Structures.

SECTION 603. ADJUSTING FRAMES AND GRATES OF DRAINAGE AND UTILITY STRUCTURES

603.01 Description. This work shall consist of adjusting the frames, with grates or lids, of existing drainage and utility structures.

603.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Building Brick (Clay or Shale)	1041.01
(c) Concrete Building Brick	1041.02
(d) Concrete Masonry Units	1042
(e) Precast Reinforced Concrete Manhole Sections	1043
(f) Gray Iron Castings	1006.14
(g) Ductile Iron Castings	1006.15
(h) Structural Steel	1006.04

CONSTRUCTION REQUIREMENTS

603.03 Two-Course Bituminous Construction. The existing pavement adjacent to and for a distance not exceeding 300 mm (12 in.) outside the base of the

casting to be adjusted shall be broken sufficiently to permit its removal. The existing pavement shall be broken and the grates adjusted just prior to placing the surface course. If the existing pavement is broken prior to placing the first course, it shall not be removed until the first course has been placed and compacted. Where a casting is enclosed in a concrete platform, the entire platform shall be broken, removed and replaced.

Prior to placing the first course, the exposed surface of each casting shall be coated with an approved release agent to prevent the bituminous mixture from adhering to it. After the first course has been placed and compacted, the bituminous mixture over each drainage or utility structure and the existing pavement adjacent to the drainage or utility structure shall be removed. The broken pavement and bituminous mixture from these areas shall be disposed of by the Contractor according to Article 202.03.

The frames shall then be adjusted to the finished pavement elevation according to the applicable portions of Section 602.

603.04 Single-Course Bituminous Construction. Prior to placing the bituminous mixture, the existing pavement adjacent to and for a distance not exceeding 300 mm (12 in.) outside the base of the casting to be adjusted shall be broken, removed and disposed of by the Contractor according to Article 202.03.

The frames shall then be adjusted to the finished pavement elevation according to the applicable portions of Section 602.

603.05 Replacement of Existing Flexible Pavement. After the castings have been adjusted, the surrounding space shall be filled with Class SI Concrete, or bituminous concrete surface or binder course material to the elevation of the surface of the base course or the binder course. If Class SI Concrete is used, it shall be cured for a period of not less than 72 hours. If bituminous concrete is used, it shall be placed in 75 mm (3 in.) layers at the required temperature and compacted with a pneumatic tamper.

603.06 Replacement of Existing Rigid Pavement. After the castings have been adjusted to the satisfaction of the Engineer, the pavement and bituminous mixture removed, shall be replaced with Class SI Concrete not less than 225 mm (9 in.) thick.

The surface of the Class SI Concrete shall be constructed flush with the surface of the adjacent bituminous mixture or pavement. Class SI Concrete shall be cured for a period of not less than 72 hours.

603.07 Protection Under Traffic. After the casting has been adjusted and the Class SI Concrete has been placed, the work shall be protected by a barricade and 2 lights for at least 72 hours. Before final surfacing operations have been started in the immediate vicinity of the structure, a bituminous mixture shall be placed around the casting, flush with its surface and decreasing to a featheredge in a distance of 600 mm (2 ft) around the entire surface of the casting. This mixture shall remain in place until surfacing operations are undertaken within the immediate area of the structure. Prior to placing the surface course, the temporary bituminous mixture shall be removed and disposed of by the Contractor according to Article 202.03.

603.08 Adjusting Rings. Adjustment of frames and grates may be accomplished through the use of approved adjusting rings. Adjusting rings shall be gray, ductile iron or structural steel. Structural steel rings shall be prefabricated as a one piece assembly. The adjusting rings shall be designed to provide a structural capacity equal to or greater than the existing or specified frame, shall not affect the opening size or surface appearance. The rings shall have a device for positively positioning and securely fastening the ring to the existing frame so as to match and maintain the surface grade and slope and prevent movement under traffic loadings.

603.09 Basis of Payment. This work will be paid for at the contract unit price each for FRAMES AND GRATES TO BE ADJUSTED or FRAMES AND LIDS TO BE ADJUSTED.

SECTION 604. FRAMES, GRATES, AND MEDIAN INLETS

604.01 Description. This work shall consist of furnishing, and installing frames, grates, lids, covers, and median inlets where such items are not included in the cost of the drainage or utility structures involved.

604.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Gray Iron Castings	1006.14
(b) Structural Steel	1006.04
(c) Ductile Iron Castings	1006.15
(d) Portland Cement Concrete	1020
(e) Reinforcement Bars and Fabric	1006.10

604.03 Materials Permitted. The materials permitted for fabrication of the various types of frames, lids, and grates and the various numbers of median inlets shall conform to the following:

Type or Number	Frame	Grate	Lid	Cover
1	Gray Iron		Gray Iron or Ductile Iron	
3 & 3V	Gray Iron	Gray Iron or Ductile Iron		
4	Gray Iron	Gray Iron or Ductile Iron		
5	Gray Iron		Gray Iron or Ductile Iron	
6	Gray Iron	Gray Iron or Ductile Iron		
7		Gray Iron or Ductile Iron		

Type or Number	Frame	Grate	Lid	Cover
8		Gray Iron or Ductile Iron		
9	Gray Iron	Gray Iron or Ductile Iron		
10	Gray Iron	Gray Iron or Ductile Iron		
11&11V	Gray Iron	Gray Iron or Ductile Iron		
12	Gray Iron	Gray Iron or Ductile Iron		
15	Gray Iron		Gray Iron or Ductile Iron	
20	Gray Iron or Ductile Iron	Gray Iron or Ductile Iron*		
21	Gray Iron or Ductile Iron	Gray Iron or Ductile Iron*		
22	Gray Iron or Ductile Iron	Gray Iron or Ductile Iron*		
23	Gray Iron or Ductile Iron	Gray Iron or Ductile Iron*		
24	Gray Iron or Ductile Iron	Gray Iron or Ductile Iron*		
Median Inlet (STD 604101)	Gray Iron	Ductile Iron		
Median Inlet (STD 604106)	Gray Iron	Ductile Iron		
2A & 2B		Gray Iron or Ductile Iron		Gray Iron or Ductile Iron
A & B		Gray Iron or Ductile Iron		

*Safety bars for the grates shall be of ductile iron.

CONSTRUCTION REQUIREMENTS

604.04 General. Frames placed on concrete or masonry surfaces shall be set in full mortar beds. The mortar shall be mixed in proportions of one part cement to three parts sand, by volume based on dry materials. Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary.

For Frames and Grates Type 6 and 12, a two piece frame may be used with the approval of the Engineer.

Removing or Filling Existing Manholes, Catch Basins and InletsArt. 605.01

For Frames and Grates, Type 20, 21, and 22, the notch in the grate and the 14 mm (9/16 in.) diameter holes in the frame are for the insertion of one galvanized M12 (1/2 in.) diameter bolt and nut. The bolt and nut shall be placed as directed by the Engineer to provide for correct replacement of the grates during maintenance operations.

When Frames and Grates, Type 21, is used in conjunction with a precast concrete barrier, a gap of at least 600 mm (2 ft) on both sides of the casting shall be provided to permit cast-in-place barrier to be constructed to incorporate the barrier box.

When Median Inlets (STD 604101) and (STD 604106) are specified, the concrete apron shall be constructed of Class SI Concrete and shall be reinforced with welded wire fabric consisting of 150 mm x 150 mm (6 in. x 6 in.) mesh, 5.7 mm (No. 4) wire, weighing 2.8 kg/sq m (58 lb/100 sq ft).

Additional reinforcement, when specified for Type 15 Frames and Lids, will be included in the unit bid price of the type of structure specified.

604.05 Basis of Payment. This work will be paid for at the contract unit price each for FRAMES, GRATES, FRAMES AND GRATES, FRAMES AND LIDS, and GRATES AND COVERS, of the type or types specified, and at the contract unit price each for MEDIAN INLETS of the number specified.

The unit price bid for Median Inlets shall include castings, concrete, and reinforcement for constructing the concrete apron.

The unit price bid for Frames and Grates, Type 22, shall include both frames and both grates, and the PAF filler placed between the two frames.

The unit price bid for Frames and Lids, Type 15, shall include the extra form work required by the special construction under CASE I or CASE II, and no additional compensation will be allowed.

SECTION 605. REMOVING OR FILLING EXISTING MANHOLES, CATCH BASINS AND INLETS

605.01 Description. This work shall consist of removing or filling existing manholes, catch basins, and inlets.

605.02 Materials. Materials shall conform to the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Brick	1041

CONSTRUCTION REQUIREMENTS

605.03 Removing Existing Manholes, Catch Basins, and Inlets. Existing manholes, catch basins and inlets designated to be removed at locations where the existing inlet and/or outlet pipes are to be abandoned, shall be removed for the full depth of structure. If the abandoned pipes are not designated to be removed, the ends of the pipe at the structure shall be sealed with Class SI Concrete or brick and mortar in a manner satisfactory to the Engineer. After the concrete or mortar has set, the hole formed by removal of the structure shall be backfilled with sand, placed and compacted to the satisfaction of the Engineer.

Existing manholes, catch basins and inlets designated to be removed at locations where flow is to be maintained in the existing storm sewer system or a proposed storm sewer is to be connected to the existing system, shall be removed to depth of at least 100 mm (4 in.) below the bottom of the storm sewer system. All debris in the structure below the storm sewer shall be removed and replaced with compacted sand to the approximate elevation of the bottom of the sewer. The existing storm sewer shall then be connected to maintain flow with pipe of the same kind and size as the existing pipe, or the proposed storm sewer shall be connected to the existing system, and the joints sealed. If a proper connection cannot be made at a joint in the existing sewer, a collar of Class SI Concrete shall be used to seal the joint. The hole formed by the removal of the structure shall then be backfilled with sand, placed and compacted to the satisfaction of the Engineer.

605.04 Filling Existing Manholes, Catch Basins, and Inlets. The tops of all existing manholes, catch basins and inlets to be filled shall be removed to an elevation of at least 75 mm (3 in.) below the earth subgrade of the proposed improvement. All inlet and/or outlet connections shall be securely sealed with Class SI Concrete or brick and mortar. After the concrete or mortar has set, the existing structure shall be filled with sand, placed, and compacted to the satisfaction of the Engineer.

605.05 Disposal of Excess Material. All material resulting from the filling or removing of existing manholes, catch basins and inlets shall be disposed of by the Contractor according to Article 202.03.

605.06 Basis of Payment. The work of removing existing manholes, catch basins and inlets at locations where the existing inlet and/or outlet pipes are to be abandoned will be paid for at the contract unit price each for REMOVING MANHOLES, REMOVING CATCH BASINS, or REMOVING INLETS, which price shall include removing and disposing of the existing structure, sealing inlet and outlet pipes, and backfilling.

The work of removing existing manholes, catch basins and inlets at locations where flow is to be maintained in the storm sewer system will be paid for at the contract unit price each for REMOVING MANHOLES TO MAINTAIN FLOW, REMOVING CATCH BASINS TO MAINTAIN FLOW, or REMOVING INLETS TO MAINTAIN FLOW, which price shall include removing and disposing of the existing structure, materials and labor to connect the existing or existing and propose storm sewers to maintain flow, and backfilling the hole with sand.

The work of filling existing manholes, catch basins and inlets will be paid for at the contract unit price each for FILLING MANHOLES, FILLING CATCH BASINS or FILLING INLETS, which price shall include removing and disposing of the top portions of the structures as necessary, sealing existing pipes when necessary, and filling the existing structures with sand.

SECTION 606. CONCRETE GUTTER, CURB, MEDIAN, AND PAVED DITCH

606.01 Description. This work shall consist of constructing concrete curb, concrete gutter, combination concrete curb and gutter, concrete median or paved ditch.

606.02 Materials. All materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Reinforcement Bars (Note 1)	1006.10
(c) Preformed Expansion Joint Filler	1051
(d) Pavement Fabric	1006.10
(e) Protective Coat	1023
(f) Dowel Bars	1006.11
(g) Polysulfide Joint Sealant.....	1050.03

Note 1. Tie bars shall be epoxy coated.

CONSTRUCTION REQUIREMENTS

606.03 Excavation. The subgrade shall be excavated according to the cross section shown on the plans. All unsuitable material shall be removed and replaced with suitable material, and the subgrade shall be compacted and finished to a firm, smooth surface.

606.04 Forms shall be according to Article 1103.05. Forms shall be securely staked, braced and held firmly to the required line and grade, and shall be sufficiently tight to prevent leakage of mortar. All forms shall be cleaned and oiled before the concrete is placed against them.

With the approval of the Engineer, a slipform paver may be used. If a slipform paver is used, the concrete slump shall be adjusted to meet the tolerances for the type of work being performed. Vertical faces may be battered at the rate of six percent from vertical to aid in slipform operations.

606.05 Placing Concrete. The improved subgrade shall extend to the back of the curb. The subgrade and forms will be checked and approved by the Engineer before the concrete is placed. The subgrade shall be moistened prior to concrete placement. The concrete shall be thoroughly tamped and spaded or mechanically vibrated and finished smooth and even. Before the concrete is given the final finish, the surface of the curb, curb and gutter, gutter or median will be checked with a 3 m

(10 ft) straightedge, and any irregularities of more than 6 mm (1/4 in.) in 3 m (10 ft) shall be eliminated.

606.06 Concrete Gutter and Curb and Gutter. Joints in concrete gutter, curb, and combination curb and gutter shall be a continuation of the joints in the adjacent portland cement concrete pavement, base course, or base course widening. Expansion joints adjacent to drainage castings may be placed in prolongation with other joint types.

Transverse joints in concrete curb and combination curb and gutter when constructed adjacent to flexible pavement shall be constructed according to the details shown on the plans. When concrete gutter is constructed adjacent to flexible pavement, two 32 mm (1 1/4 in.) diameter x 450 mm (18 in.) long dowel bars shall be installed in all transverse joints. The transverse joints shall be contraction joints spaced on 8 m (25 ft) centers.

At points where the proposed or existing sidewalk or driveway pavement occupies the entire space between the proposed curb and an adjacent building or permanent structure, 25 mm (1 in.) preformed expansion joint shall be placed between the sidewalk, building, or driveway pavement and the proposed curb. The expansion joint material shall extend the entire depth of the sidewalk, or driveway pavement, or to such depth as will allow 25 mm (1 in.) expansion between the proposed curb and adjacent sidewalk, building or driveway pavement.

Longitudinal construction, transverse contraction, and expansion joints shall be constructed according to the applicable portions of Article 420.10. Contraction joints shall be sawed to a depth equal to 1/3 the thickness of the gutter flag and to a width of not less than 3 mm (1/8 in.). The expansion joint filler material shall be cut to the exact cross section of the gutter, curb or combination curb and gutter. The bars in contraction joints will be required for monolithic construction only. Dowel bars for expansion and contraction joints in combination concrete curb and gutter shall be spaced as shown on the plans, except only one dowel bar will be required at a joint if the width of the gutter is less than 450 mm (18 in.).

Transverse contraction and longitudinal construction joints shall be sealed according to Article 420.14(a), except transverse joints in concrete curb and gutter shall be sealed with an approved polysulfide sealer.

When combination concrete curb and gutter is constructed across alleys or private drives, or where directed by the Engineer, the top of curbs shall be depressed according to the details shown on the plans. The transition from full height curb to depressed curb shall be made in a distance equal to at least four times the difference in height from the full height to the depressed curb.

Areas of adjacent portland cement concrete pavement, base course or base course widening less than 300 mm (12 in.) in width shall be constructed monolithic with the curb or combination curb and gutter. These areas of pavement, base course or base course widening will be included in the measured areas of the adjacent pavement, base course or base course widening. Where base course or base course widening is specified to extend under the curb and gutter, the curb and gutter may be poured full depth of the pavement in lieu of the base course.

Curb and combination curb and gutter may be constructed monolithically with portland cement concrete pavement, base course or base course widening greater than 300 mm (12 in.). Tie bars between the slab and the gutter will not be required when constructed monolithically with portland cement concrete pavement, but will be required when constructed monolithically with portland cement concrete base course or base course widening. The tie bars shall be held in the proper position by support pins or placed by approved mechanical means. Pavement reinforcement, when required in pavement, shall be extended laterally to within 75 mm (3 in.) to 125 mm (5 in.) from the back of the curb. The forming of longitudinal joints between the portland cement concrete pavement, base course or base course widening and the curb or combination curb and gutter will not be required.

Transition from one type of gutter, curb or curb and gutter to another type shall be constructed according to the details shown on the plans or as directed by the Engineer.

606.07 Inlets, Entrances and Outlets for Gutter and Curb and Gutter.

Inlets, entrances and outlets for concrete gutter, and outlets for combination concrete curb and gutter shall be constructed according to the details shown on the plans or as directed by the Engineer.

The longitudinal and transverse joints shall be according to Article 606.06.

Pipe drains for outlets of the drop-box type shall be either corrugated steel or aluminum alloy pipe constructed according to the applicable portions of Section 601. The grates and covers shall conform to the applicable portions of Section 604.

606.08 Concrete Medians. Concrete medians shall be constructed at the locations, of the types, and according to the details shown on the plans or as directed by the Engineer.

For Type P surface median, grooves 25 mm (1 in.) deep shall be formed in the plastic concrete at 3 m (10 ft) maximum intervals both transversely and longitudinally. Grooves also shall be formed at the corner points of all holes boxed out for sign and signal posts. A 20 mm (3/4 in.) diameter plastic tube shall be installed through the back of the curb at 30 m (100 ft) intervals on the low side or sides of the median and two at the low end to provide drainage.

Aggregate fill, when required under paved median, shall be gradation CA 7, CA 8, CA 11, CA 13, CA 14, CA 15, or CA 16 according to Article 1004.06 and shall be placed in layers 100 mm (4 in.) thick and compacted to the satisfaction of the Engineer.

Portland cement concrete pavement, base course or base course widening less than 300 mm (12 in.) in width that is directly adjacent to concrete median shall be constructed monolithically with the median but the area will be included in the measured area of the adjacent pavement, base course or base course widening.

The transverse joints in Type P surface median shall be expansion joints consisting of preformed expansion joint filler 20 mm (3/4 in.) thick, conforming to the full cross section of the median surface, and placed at intervals of 9 m (30 ft) in the median surface. At least one joint shall be constructed in each median island.

For all other types of median when constructed adjacent to portland cement concrete pavement, base course or base course widening, transverse joints shall be in prolongation with joints in the pavement, base course or base course widening and shall be of the same type except that dowel bars or tie bars will not be required. For corrugated medians, the Contractor has the option of constructing the joints with 20 mm (3/4 in.) preformed expansion joint filler conforming to the full cross section of the median. When constructed adjacent to flexible pavement, transverse joints shall be contraction joints at 6 m (20 ft) intervals.

Contraction joints shall be formed by sawing to a depth of 1/3 the thickness of the median and sealed according to Article 420.14(a). Expansion joints shall be formed by placing 20 mm (3/4 in.) thick preformed expansion joint filler conforming to the full cross section of the median. When permitted by the Engineer, expansion joints may be substituted for contraction joints.

606.09 Paved Ditch. Paved ditch shall be constructed at the locations and according to the details shown on the plans or as directed by the Engineer.

Anchor walls shall be spaced at not more than 15 m (50 ft) intervals along the paved ditch. Anchor walls and the cut-off wall shall be constructed monolithically with the paved ditch.

At the option of the Contractor, No. 10 (No. 3) reinforcing bars placed at 300 mm (12 in.) centers longitudinally in the paved ditch and vertically in the anchor and cut-off walls may be used in lieu of the welded wire fabric.

A 13 mm (1/2 in.) thick preformed joint filler shall be placed at the junction of paved ditch with any other structure.

606.10 Finishing. All exposed surfaces shall be finished smooth and even, and given a light brush finish while the concrete is still workable. The edges shall be rounded with approved finishing tools having the radii shown on the plans.

Forms shall be removed within 24 hours after the concrete has been placed and minor defects shall be filled with mortar consisting of one part portland cement to two parts fine aggregate.

606.11 Protective Coat. Protective coat, when required, shall be constructed according to Article 420.21.

606.12 Backfill. After the concrete has obtained the specified strength or when directed by the Engineer, the spaces in front and back of the construction shall be backfilled to the required elevation with suitable material, compacted, and neatly graded to the satisfaction of the Engineer.

606.13 Method of Measurement.

- (a) **Contract Quantities.** The requirement for use of contract quantities shall be according to Article 202.07(a).

- (b) **Measured Quantities.** Concrete curb, concrete gutter, combination concrete curb and gutter and paved ditch will be measured for payment in meters (feet) in the flow line of the gutter or paved ditch and along the face of concrete curb, which measurement will include drainage castings incorporated in various curbs and gutters but will exclude entrances, inlets and outlets for gutters and outlets for combination curb and gutters. The lengths of transitions from one type of gutter or curb and gutter to another will be included in the measured quantities for the types having the largest cross sectional areas of concrete.

The various types of concrete median will be measured for payment in place and the area computed in square meters (square feet). Concrete curb and gutter around solid concrete median will not be measured separately for payment. Concrete curb and gutter around Type P median surface will be measured separately for payment in meters (feet). The areas of ramp noses will be included in the measured quantities of concrete medians in which they are included.

Concrete inlets, entrances and outlets for gutters and outlets for combination curb and gutter will be measured for payment in place and the volume of concrete computed in cubic meters (cubic yards). Pipe drains for outlets of the drop box type will be measured for payment according to Article 601.07. Tie bars will be measured according to Article 508.07.

606.14 Basis of Payment. Concrete gutter, curb and combination curb and gutter will be paid for at the contract unit price per meter (foot) for CONCRETE GUTTER, CONCRETE CURB or COMBINATION CONCRETE CURB AND GUTTER, of the type specified.

Concrete median will be paid for at the contract unit price per square meter (square foot) for CORRUGATED MEDIAN; CONCRETE MEDIAN SURFACE, 100 mm (4 in.) or CONCRETE MEDIAN, of the type specified. For solid concrete median the unit price will also include concrete curb and gutter.

Concrete inlets, entrances and outlets for gutter and outlets for combination curb and gutter will be paid for at the contract unit price per cubic meter (cubic yard) for CLASS SI CONCRETE (OUTLET). Grates and covers used with drop box type outlets will be paid for according to Article 604.05. Pipe drains for drop box type outlets will be paid for according to Article 601.08.

Paved ditch will be paid for at the contract unit price per meter (foot) for PAVED DITCH, of the type specified.

Protective Coat will be paid for according to Article 420.23.

Excavation required in the performance of the work will be measured and paid for according to Section 202.

SECTION 607. SLUICE GATE

607.01 Description. This work shall consist of furnishing, fabricating, transporting and installing a sluice gate of the size shown on the plans with all the necessary appurtenances.

607.02 Materials. Materials shall meet the requirements of AWWA C501 Section 2 - Materials.

CONSTRUCTION REQUIREMENTS

607.03 General. The sluice gate shall be constructed in such a manner as to meet the requirements of AWWA C501 Section 3 - General Design and Section 4 - Fabrication.

All wedges shall be provided with wedge adjusting screws and lock nuts.

All manual floor stands shall be provided with clear butyrate plastic pipe covers with mylar position indicator.

607.04 Painting. All cleaning, painting, and protecting of the sluice gate shall be according to AWWA C501 Section 3.13 - Painting. A finish coat of black asphalt base coating shall be applied in the field to all submerged parts. The lifting device shall be painted with a machinery enamel suitable for outdoor service.

607.05 Installation. The sluice gate shall be installed and tested according to AWWA C501 Section 6 - Installation.

607.06 Drawings and Manuals. Before any fabrication has begun, the Contractor shall submit four complete sets of shop drawings to the Engineer for approval.

Four copies of the manual giving complete information on installation, lubrication and maintenance shall be provided to the Engineer by the Contractor.

607.07 Basis of Payment. This work will be paid for at the contract unit price each for SLUICE GATE, of the type and size specified, which price shall include furnishing and installing the sluice gate complete and operating, including assembling as recommended by the manufacturer, installation of a wall thimble when required, and field painting.

SECTION 608. FLAP GATES

608.01 Description. This work shall consist of furnishing, fabricating, painting, transporting and installing a flap gate of the size, shape and design head shown on the plans together with the necessary appurtenances.

608.02 Materials. Materials shall meet the requirements of the following Article of Section 1000 - Materials:

Item	Article/Section
(a) Flap Gate	1044

CONSTRUCTION REQUIREMENTS

608.03 Fabrication. Before fabrication of the component parts of the flap gate is initiated, shop drawings showing the dimensions and details required to locate and install the component assemblies shall be submitted for the Engineer's approval.

608.04 Installation. Prior to initiating installation of the flap gate, the Contractor shall provide the Engineer with 4 copies of a manual giving complete information on installation, lubrication, and maintenance of the flap gate.

The flap gate shall be installed according to the manufacturer's recommendations and as directed by the Engineer. The gate shall be installed in a plumb position with the axis of the hinge perpendicular to the centerline of the waterway opening.

The quantity and size of the fasteners shall be as recommended by the manufacturer. Flat back seat gates attached to concrete shall be mounted on anchor bolts and grouted in place. The anchor bolts shall be furnished with two nuts each to facilitate installation and alignment.

608.05 Basis of Payment. Flap gates will be paid for at the contract unit price each for FLAP GATE, of the size specified.

SECTION 609. BRIDGE APPROACH PAVEMENT AND SHOULDER PAVEMENT DRAINS

609.01 Description. This work shall consist of constructing bridge approach pavement drains and bridge approach shoulder pavement drains according to the details shown on the plans.

609.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland cement concrete	1020
(b) Gray Iron Castings	1006.14
(c) Ductile Iron Castings	1006.15
(d) Structural Steel	1006.04
(e) Reinforcement Bars	1006.10
(f) Bedding Layer (Note 1)	1004.01

Note 1: Gradation CA 6, CA 10, or CA 12 of D quality or better.

Steel frames shall be galvanized after fabrication according to the requirements of AASHTO M 111.

CONSTRUCTION REQUIREMENTS

609.03 Inlet Boxes. Inlet boxes shall be either cast-in-place of Class SI Concrete according to the applicable portions of Section 503 or precast of Class PC Concrete according to the applicable portions of Section 504. Shop drawing for precast inlet boxes will not be required. A 75 mm (3 in.) thick bedding layer shall be provided under the full length and width of precast units.

609.04 Frames and Grates. Either steel or cast iron frames shall be used. Cast grates shall be used and shall seat firmly in the frame.

609.05 Pipe Drains. Pipe drains shall conform to the applicable portions of Section 601, except that the material shall be corrugated steel, aluminum alloy, or polyethylene (PE) pipe, sand bedding will not be required, and corrugated steel and aluminum alloy pipe shall have 600 mm (2 ft) couplings.

All pipe connections shall be watertight and all voids around the pipe drain entrance shall be sealed with mortar both inside and outside the inlet box.

When steel or aluminum pipe is used the end section shall be of the same material as the pipe. When polyethylene (PE) pipe is used the end section shall be steel or aluminum.

609.06 Thrust Blocks. Thrust blocks, when required, shall be cast-in-place of Class SI Concrete. Thrust blocks will not be required when the difference in elevation between the inlet box invert and pipe drain outfall is less than 900 mm (3 ft).

609.07 Basis of Payment. Inlet boxes complete in place will be paid for at the contract unit price each for TYPE B, C, or D INLET BOX STANDARD 609001 or TYPE C or D INLET BOX STANDARD 609006.

Pipe drains will be measured and paid for according to Section 601.

End sections will be measured and paid for according to Section 542.

Thrust blocks will be paid for at the contract unit price each for CONCRETE THRUST BLOCKS.

SECTION 610. SHOULDER INLETS WITH CURB

610.01 Description. This work shall consist of constructing shoulder inlets with curb according to the details shown on the plans and as specified.

610.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Gray Iron Castings	1006.14
(c) Ductile Iron Castings	1006.15
(d) Structural Steel	1006.04
(e) Reinforcement Bars	1006.10

CONSTRUCTION REQUIREMENTS

610.03 Inlet Boxes. Inlet boxes shall be constructed according to Article 609.03.

610.04 Frames and Grates. Frames and Grates shall be according to Article 609.04.

610.05 Pipe Drains. Pipe Drains shall be constructed according to Article 609.05.

610.06 Thrust Blocks. Thrust blocks shall be constructed according to Article 609.06

610.07 Portland Cement Concrete Slab. The portland cement concrete slab shall be constructed of Class SH Concrete according to the applicable portions of Section 483.

When shoulder inlets are constructed in conjunction with new bituminous shoulders, the bituminous shoulder shall be constructed first and then sawed full depth and removed in the area of the portland cement concrete slab. The area of bituminous shoulder removed for the construction of the portland cement concrete slab will be included in the area of bituminous shoulders measured for payment.

When the portland cement concrete slab is constructed in conjunction with new portland cement concrete shoulders, the slab may be constructed separately or monolithically with the shoulders at the option of the Contractor.

The lengths of reinforcement bars used in the portland cement concrete slab shall be such as to accommodate the lengths, width, and spacing shown on the plans, or as directed by the Engineer.

610.08 Shoulder Curb. When shoulder inlets are constructed in conjunction with new bituminous shoulders, a bituminous curb shall be constructed according to Section 661. When shoulder inlets are constructed in conjunction with new portland cement concrete shoulders, a portland cement concrete shoulder curb shall be constructed according to Section 662.

610.09 Basis of Payment. Inlet boxes complete in place will be paid for at the contract unit price each for TYPE E INLET BOX, STANDARD 610001 or TYPE F INLET BOX, STANDARD 610001.

Pipe drains will be measured and paid for according to Section 601.

End sections will be measured and paid for according to Section 542.

Thrust blocks will be paid for according to Article 609.07.

The portland cement concrete slab will be paid for at the contract unit price per square meter (square yard) for PORTLAND CEMENT CONCRETE SHOULDERS, of the thickness specified, measured according to Article 483.11 except that a deduction will be made for the area displaced by the inlet box, which price shall include sawing, removal and disposal of the bituminous shoulder, subgrade preparation, and furnishing and placing concrete, reinforcement bars, and tie bars or expansion anchor ties.

Shoulder curb will be measured and paid for according to Section 661 or Section 662.

SECTION 611. TREATMENT OF EXISTING FIELD TILE SYSTEMS

611.01 Description. This work shall consist of locating and treating existing field tile systems within the limits of the right of way.

CONSTRUCTION REQUIREMENTS

611.02 Locating Existing Field Tile. Existing field tile in those areas where they are reported or suspected to exist shall be located by constructing exploration trench according to Section 213. The depth of the exploration trench shall be 1.3 m (52 in.).

611.03 Existing Field Tile Intercepted by Backslopes. Existing field tile which are intercepted by the backslopes of the roadway after the ditches have been cut shall have the upstream ends tightly sealed with Class SI Concrete or brick and mortar to the satisfaction of the Engineer.

If specified on the plans or required by the Engineer, the existing field tile within the limits of the pavement and paved shoulders shall be removed or crushed. Removing or crushing existing field tile shall be accomplished by constructing exploration trench along the line of the tile. All trenches cut for the purpose of removing or crushing existing tile within the limits of 600 mm (2 ft) outside the proposed pavement and paved shoulders shall be backfilled to the existing ground line in fill sections and to the elevation of the earth subgrade in cut sections with trench backfill according to Section 208 and compacted according to Article 550.07.

Pipe drains, conforming to the applicable portions of Section 601, shall be used for the terminal 3 m (10 ft) of the existing field tile where it is outletted into the roadway ditch. The pipe drain shall be a single length section of a diameter equal to the diameter of the existing field tile plus 50 mm (2 in.), but not less than 150 mm (6 in.).

Pipe drains outletting into a roadway ditch shall have a concrete headwall constructed at the outlet end according to the details shown on the plans. The headwall shall be constructed of Class SI Concrete according to the applicable portion of Section 503.

611.04 Field Tile Not Intercepted by Backslopes. Storm sewer shall be used to replace existing field tile within the right of way at locations where the existing tile crosses under the roadway and below the roadway ditches, and shall be constructed according to Section 550.

Storm Sewer Protected shall be used to replace existing field tile within the right of way at locations where the existing tile crosses under the roadway and below the roadway ditch. The kinds of material permitted for Storm Sewer Protected shall be Class A according to Article 550.03. Additional protection shall be provided for the storm sewer at roadway ditches by constructing a concrete slab or paved ditch section over the pipe according to the details shown on the plans. The concrete slab shall be used whenever the cover over the slab at the bottom of the ditch is 100 mm (4 in.) or more. The paved ditch section shall be used when the cover is less than 100 mm (4 in.). The concrete slab and paved ditch section shall be constructed of Class SI Concrete according to the applicable portions of Section 503.

Storm Sewer (Special) shall be used to replace existing field tile within the right of way at locations where the existing tile does not cross under the roadway and is not outlet into the roadway ditch. The kinds of material permitted for Storm Sewer (Special) shall be according to Article 550.03 for Storm Sewers, Type 2. Storm Sewer (Special) shall be constructed according to Section 550, except that in lieu of the sand bedding the pipe may be installed according to Article 601.03 and joints between pipe sections shall not be sealed.

At locations where Storm Sewer (Special) is outletted into a ditch, a concrete headwall according to Article 601.05 for pipe drains shall be constructed at the outlet end.

611.05 Field Tile Junction Vaults. Field tile junction vaults, shall be used at locations where two or more drain lines intersect, where a sharp directional change of flow is required, or where storm sewer or Storm Sewer (Special) connects to existing field tile. Field tile junction vaults shall be constructed according to the details shown on the plans and the applicable portions of Section 602. Frame and grate, when required, shall be cast iron. All junctions between pipes and vault shall be sealed with mortar consisting of one part portland cement to two parts sand.

611.06 Method of Measurement. Exploration trench for locating existing field tile and for removing or crushing existing field tile will be measured for payment in meters (feet) of actual trench constructed.

Storm Sewers Protected and Storm Sewers (Special) of the various diameters will be measured for payment in place in meters (feet).

Concrete headwalls, concrete slabs and paved ditch sections will be measured for payment in place and the volume computed in cubic meters (cubic yards).

611.07 Basis of Payment. Locating existing field tile and removing or crushing existing field tile will be paid for at the contract unit price per meter (foot) for EXPLORATION TRENCH [1.3 m (52 in.) DEPTH], which price shall include backfilling the trench and replacement of broken tile as required.

Pipe drains will be measured and paid for according to Section 601.

Storm Sewer Protected will be paid for at the contract unit price per meter (foot) for STORM SEWER PROTECTED, CLASS A, of the type and diameter specified, which price shall include all pipe fitting and all other materials except trench backfill, all excavation except excavation in rock, backfilling, providing all sheeting or shoring.

Storm Sewer (Special) will be paid for at the contract unit price per meter (foot) for STORM SEWER (SPECIAL), of the diameter specified, which price shall include all pipe fittings and other materials required, all excavation except excavation in rock, backfilling, and all sheeting and shoring.

Concrete headwalls, concrete slabs and paved ditch sections required for this work will be paid for at the contract unit price per cubic meter (cubic yard) for MISCELLANEOUS CONCRETE, which price shall include the welded wire fabric reinforcement and all excavation and backfill.

Field tile junction vaults will be paid for at the contract unit price each for FIELD TILE JUNCTION VAULTS, of the diameter specified, which price shall include furnishing and placing the sand cushion when required and the frame and grate or precast concrete lid.

Trench backfill will be measured and paid for according to Section 208.

Excavation in rock will be measured and paid for according to Section 502 for Rock Excavation for Structures.

Removal and replacement of unsuitable material below bedding grade will be paid for according to Article 109.04.

Sealing the ends of existing field tile will not be paid for as a separate item, but shall be considered as included in the unit prices bid for the various pay items of work involved.

SAFETY RELATED ITEMS

SECTION 630. STEEL PLATE BEAM GUARDRAIL

630.01 Description. This work shall consist of furnishing and erecting steel plate beam guardrail and posts.

630.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Rail Element Plates, End Section Plates, and Splice Plates	1006.25
(b) Bolts, Nuts, Washers, and Hardware	1006.25
(c) Wood Posts and Wood Block	1007.01, 1007.02, 1007.06
(d) Steel Posts, Blockouts, Restraints and Wire Rope for Guardrail	1006.04
(e) Preservative Treatment	1007.12
(f) Portland Cement Concrete	1020
(g) Reinforcement Bars	1006.10

CONSTRUCTION REQUIREMENTS

630.03 General. When steel block-outs are mounted on wood posts, M16 (5/8 in.) diameter by 90 mm (3 1/2 in.) long lag screws installed in pre-drilled holes shall be used in lieu of the post bolts and nuts. All holes in posts and blockouts shall be 19 mm (3/4 in.).

Load tests shall be conducted on ten percent of all anchor bolts used in guardrail installation. The tests shall be conducted in the presence of the Engineer. The equipment and method used shall meet the approval of the Engineer. The minimum test load shall be 35 kN (8000 lb) for M22 (7/8 in.) diameter bolts and 13 kN (3000 lb) for M16 (5/8 in.) diameter bolts in direct pull. For each anchor bolt that fails the test, two more anchor bolts selected by the Engineer shall be tested. Each anchor bolt that fails to meet the test requirements shall be reset, or removed and the hole drilled deeper and reset, and retested until the anchor bolt passes the local test.

All rail elements shall be lapped in the direction of traffic in the adjacent lane.

630.04 Fabrication. The plates for the rail element shall be blanked to proper shape, fabricated and ready for assembly when received. No punching, drilling, cutting or welding will be permitted in the field. The plates shall be of uniform section. Deformed plates will be rejected. The edges of the plates shall be rolled or rounded so that they present no sharp edges. All connections and splices shall be made with button head bolts with oval shoulders, or in such a manner that there shall be no appreciable projection on the road side of the guardrail.

Where steel plate beam guardrail is constructed on curves which have a radius of 45 m (150 ft) or less, the rail element plate shall be shop curved to the proper radius with the road side of the rail either concave or convex as required.

Plate ends in lap splices shall make contact throughout the entire area of the splice. All bolts in curved or deformed portions of the rail element shall be fabricated in such a manner that satisfactory bearing is obtained under the bolt head.

Each length of guardrail shall be finished at the ends as shown on the plans. Rail elements shall be furnished in nominal lengths of either 3.8 m (12 ft 6 in.) or 7.6 m (25 ft 0 in.).

630.05 Posts. Wood posts and blocks shall be treated. The posts and blocks shall be cut to the proper dimensions before treatment. No cutting of the posts or blocks will be permitted after treatment. Posts shall be erected according to Article 634.05.

If steel posts are used, they may be driven by hand or mechanical methods provided they are protected by a suitable driving cap and the earth around the posts compacted, if necessary, after driving. When steel posts are driven to incorrect alignment or grade, they shall be removed and set according to Article 634.05.

Only steel posts shall be used when the guardrail is mounted on existing culverts. When it is necessary to shorten the posts in the field, the lower portion shall be cut off in a manner to provide a smooth cut with minimum damage to the galvanizing. Cut areas shall be repaired according to the requirements of AASHTO M 36M (M 36).

630.06 Shoulder Stabilization at Guardrail. Shoulder stabilization shall be constructed at the locations of steel plate beam guardrail installation according to the details shown on the plans. On new construction projects, the material used in the shoulder stabilization shall be the same as that used in the adjacent paved shoulder. On shoulder resurfacing projects, the material used in the shoulder stabilization shall be the same as that used for the shoulder resurfacing.

When portland cement concrete is used, shoulder stabilization shall be constructed according to the applicable portions of Section 483. The shoulder stabilization shall be constructed simultaneously with the adjacent portland cement concrete shoulder. Guardrail posts shall be driven through round blockouts or holes cored in the completed shoulder stabilization. The voids around the posts shall be backfilled with a bituminous mixture approved by the Engineer.

When bituminous concrete is used, shoulder stabilization shall be constructed according to the applicable portions of Section 482. On new construction, the shoulder stabilization shall be constructed simultaneously with the bituminous shoulder. On shoulder resurfacing projects, the portion of the shoulder stabilization below the surface of the existing paved shoulder shall be placed and compacted separately. The guardrail posts shall be driven through holes cored in the completed shoulder stabilization and the voids around the posts shall be backfilled with a bituminous mixture approved by the Engineer.

630.07 Method of Measurement. Steel Plate Beam Guardrail will be measured for payment in meters (feet). The length measured will be the overall length of the single or double rail erected measured along the top edge of the rail elements to the limits shown on the plans. Two rails attached to a single post will be measured as double rail.

Steel plate beam guardrail mounted on existing culverts will be measured for payment in meters (feet) extending from center to center of the first post driven adjacent to the structure.

Portland cement concrete shoulder stabilization at guardrail will be measured for payment according to Article 483.11. Bituminous shoulder stabilization at guardrail will be measured for payment according to Article 482.08.

630.08 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for STEEL PLATE BEAM GUARDRAIL, of the type specified.

When end sections are specified, they will not be paid for as a separate item, but shall be considered as included in the unit price for Steel Plate Beam Guardrail.

Steel plate beam guardrail mounted on existing culverts will be paid for at the contract unit price per meter (foot) for STEEL PLATE BEAM GUARDRAIL, ATTACHED TO STRUCTURES, which price shall include special posts and attachments for connecting the guardrail to existing culverts.

Portland cement concrete shoulder stabilization at guardrail will be paid for according to Article 483.12.

Bituminous shoulder stabilization at guardrail will be paid for according to Article 482.09.

Excavation in rock will be paid for according to Section 502 for Rock Excavation for Structures.

SECTION 631. TRAFFIC BARRIER TERMINALS

631.01 Description. This work shall consist of furnishing and erecting traffic barrier terminals.

631.02 Materials. Materials shall meet the requirement of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Rail Element Plates, End Section Plates, and Splice Plates	1006.25
(b) Bolts, Nuts, Washers and Hardware	1006.25
(c) Wood Posts and Wood Block	1007.01, 1007.02, 1007.06
(d) Preservative Treatment	1007.12
(e) Steel Posts	1006.04
(f) Rubrail, Structural Shapes, and Plates	1006.04
(g) Preservative Treatment	1007.12
(h) Hollow Structural Tubing	1006.27(b)

CONSTRUCTION REQUIREMENTS

631.03 General. Traffic barrier terminals shall be constructed according to Articles 630.03 through 630.06.

631.04 Traffic Barrier Terminal, Type 1B. The excavated area around the buried portion of the terminal shall be backfilled according to Article 502.10 except that granular material shall not be used.

631.05 Traffic Barrier Terminal, Type 4. When the pavement is on a curved alignment, the guardrail in the traffic barrier terminal assembly shall be curved to match the alignment.

631.06 Traffic Barrier Terminal, Type 5 and Type 5A. The face of the guardrail shall be installed flush with the face of the bridge rail or parapet.

631.07 Traffic Barrier Terminal, Type 6. When attaching the end shoe to concrete, constructed with forms, and with a thickness of 300 mm (12 in.) or less, the holes may be formed, core drilled, or an approved 20 mm (3/4 in.) cast-in-place insert may be used.

When attaching the end shoe to concrete, constructed with forms and with a thickness greater than 300 mm (12 in.), an approved M20 (3/4 in.) bolt with an approved expansion device may be used, in lieu of core drilled or formed holes.

When attaching the end shoe to concrete constructed by slipforming, the holes shall be core drilled unless otherwise approved by the Engineer.

Wood block outs shall be used on all slope faced appurtenances.

631.08 Traffic Barrier Terminal, Type 8. The rail section on the turned down curb connector shall be a 7.6 m (25 ft) long section.

When a bridge expansion joint exists between the end shoe and the first post, all splice bolts and the end shoe and post bolts at the brackets shall be fitted with a lock nut or double nut and tightened only to a point that will allow guardrail movement.

631.09 Traffic Barrier Terminal, Type 10. If any portion of the existing name plate of the bridge will be covered by the end shoe, the name plate shall be moved to an adjacent area along the rail or end post before the end shoe is installed.

The standard end shoe shall be attached to the existing concrete with pre-drilled or self-drilling anchor bolts. The anchor cone shall be set flush with the surface of the concrete. Externally threaded studs protruding from the surface of the concrete will not be permitted. The standard end shoe shall be placed between the splice plate and the rail element.

The distance between any anchor and the edge of existing concrete shall be 150 mm (6 in.).

When a bridge expansion joint exists between the end shoe and the first post, all splice bolts at the end shoe shall be fitted with a lock nut or double nuts and tightened only to a point that will allow guardrail movement.

631.10 Method of Measurement. The various types of traffic barrier terminals will be measured for payment complete in place in units of each. The pay limit between the traffic barrier terminal and the adjacent guardrail shall be as shown on the plans, except that it shall be at the centerline of the end shoe splice for Traffic Barrier Terminal, Type 10.

631.11 Basis of Payment. This work will be paid for at the contract unit price each for TRAFFIC BARRIER TERMINAL, of the type specified, which price shall include furnishing and installing all parts and materials, all excavation except excavation in rock, all backfilling, and moving of existing name plates when required.

The contract unit price each for TRAFFIC BARRIER TERMINAL, TYPE 11, shall include any relocation of the traffic barrier terminal required in conjunction with the relocation of the Temporary Bridge Rail but does not include the Temporary Concrete Barrier.

The contract unit price each for TRAFFIC BARRIER TERMINAL, TYPE 3A, shall include drilling the holes and attaching the terminal to the Concrete Barrier but does not include the Concrete Barrier.

The contract unit price each for TRAFFIC BARRIER TERMINAL, TYPE 4A, shall include the cost of the end section.

Excavation in rock will be paid for according to Section 502 for Rock Excavation for Structures.

When widening of existing shoulders is required for the construction of traffic barrier terminals, the earthwork will be paid for according to Section 204 for Borrow and Furnished Excavation.

SECTION 632. GUARDRAIL AND CABLE ROAD GUARD REMOVAL

632.01 Description. This work shall consist of the removal and disposal of existing guardrail and cable road guard.

CONSTRUCTION REQUIREMENTS

632.02 General. The guardrail and cable road guard shall be removed so that all material considered suitable by the Engineer for future use shall be salvaged. Posts having salvage value shall be removed without damage and those having no salvage value shall be pulled, or cut off at least 150 mm (6 in.) below the ground surface. All holes shall be filled and tamped. The salvaged material shall be stored at locations and in a manner approved by the Engineer. Any of this material having salvage value and which has been damaged by the Contractor shall be replaced at his/her own expense with new material of the same kind.

632.03 Method of Measurement. Guardrail and cable road guard removal will be measured for payment in meters (feet), measured from center to center of end posts.

632.04 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for GUARDRAIL REMOVAL or CABLE ROAD GUARD REMOVAL, which price shall include removing end sections and traffic barrier terminals, storing all salvageable material, and disposing of all materials that are not to be salvaged.

SECTION 633. REMOVING AND REERECTING GUARDRAIL AND TERMINALS

633.01 Description. This work shall consist of the complete removal and reerection of existing steel plate beam guardrail and traffic barrier terminals, or the rail elements of existing steel plate beam guardrail and traffic barrier terminals.

633.02 Materials. New materials, when required, shall meet the requirements of Articles 630.02 and 631.02.

CONSTRUCTION REQUIREMENTS

633.03 General. The removal and reerection of existing steel plate beam guardrail and traffic barrier terminals shall be performed according to the applicable portions of Sections 630, 631 and 632.

New bolts, nuts and washers shall be used throughout in the reerection work. When specified on the plans, existing wood posts shall be replaced with new steel posts and existing blockouts shall be replaced with new adjustable steel blockouts. Rail elements and posts that are damaged during removal or that are otherwise unsatisfactory for reerection shall be replaced.

Existing bolts shall be removed by removing or shearing the nuts. The use of a cutting torch to remove existing bolts will not be allowed.

When removal and reerection includes the rail element only, the guardrail shall be temporarily stored against the posts or at the shoulder line. The existing posts shall not be exposed overnight without rail elements.

The complete guardrail, guardrail elements and traffic barrier terminals shall be reerected at the locations and according to the details shown on the plans.

633.04 Method of Measurement. The complete removal and reerection of the various types of steel plate beam guardrail will be measured for payment in meters (feet) in place at the location of reerection.

The complete removal and reerection of the various types of traffic barrier terminals will be measured for payment in place at the location of reerection in units of each according to Article 631.10.

The removal and reerection of the rail elements of steel plate beam guardrail and adjoining traffic barrier terminals will be measured for payment in meters (feet), measured from center to center of end posts.

633.05 Basis of Payment. The work of complete removal and reerection will be paid for at the contract unit price per meter (foot) for REMOVE AND REERECT STEEL PLATE BEAM GUARDRAIL, of the type specified, and at the contract unit price each for REMOVE AND REERECT TRAFFIC BARRIER TERMINALS, of the type specified. These prices shall include removal and temporary storage if necessary, furnishing new bolts, nuts and washers, furnishing new posts and blockouts when specified, and the reerection at the same location, including all excavation and backfill except excavation in rock. Replacement of unsatisfactory rail

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elements and posts except those damaged during removal and required to be replaced by the Contractor at his/her own expense will be paid for according to Article 109.04.

The work of removal and reerection of rail elements only will be paid for at the contract unit price per meter (foot) for REMOVE AND REERECT RAIL ELEMENT OF EXISTING GUARDRAIL, which price shall include furnishing new bolts, nuts and washers, and replacing existing blockouts with new adjustable steel blockouts when specified. Replacement of unsatisfactory rail elements except those damaged during removal which will be required to be replaced by the Contractor at his/her own expense will be paid for according to Article 109.04.

Excavation in rock will be paid for according to Section 502 for Rock Excavation for Structures.

SECTION 634. GUARD POSTS

634.01 Description. This work shall consist of furnishing and setting guard posts.

634.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Guard Posts	1007.01, 1007.02, 1007.09
(b) Preservative Treatment	1007.12

CONSTRUCTION REQUIREMENTS

634.03 Preparation of Posts. The bottom of the posts shall be sawed square, and the tops shall be rounded to a hemisphere. This sawing and rounding shall be performed at the source of supply, and not in the field. All posts shall be peeled by removing all of the rough bark and at least 80 percent of the inner bark. All knots and projections shall be shaved smooth and flush with the surrounding wood.

634.04 Preservative Treatment. The posts shall be pressure treated after the sawing and rounding have been performed.

634.05 Setting Posts. The posts shall be set in compacted soil. The material in the bottom of the post holes shall be compacted to provide a stable foundation. The posts shall be set plumb with the front faces forming a smooth line. After the posts are in place, the holes shall be backfilled in layers with approved materials compacted in such a manner as not to displace the posts from correct alignment.

In lieu of setting posts in previously dug holes, the posts may be driven provided they are protected by a suitable driving cap, no damage is done to any portion of the post, they are driven plumb to the required depth and alignment with adequate lateral stability, and provided that the shoulders and adjacent slopes are not damaged from the driving operations. When, in the opinion of the Engineer, driving operations are producing unsatisfactory results, the posts shall be set in dug or bored holes.

634.06 Basis of Payment. This work will be paid for at the contract unit price each for GUARD POSTS.

Excavation in rock will be paid for according to Section 502 for Rock Excavation for Structures.

SECTION 635. DELINEATORS

635.01 Description. This work shall consist of furnishing, installing, removing, and reinstalling delineator posts and reflectors.

635.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Metal Posts for Highway Markers, Signs and Delineators	1006.29
(b) Reflectors for Delineators	1097.03

CONSTRUCTION REQUIREMENTS

635.03 General. Delineators shall be spaced as shown on the plans. The spacing shall be carried across structures without interruption by means of bracket mountings fastened to the bridge rail. If the designated spacing causes a delineator location to occur at a pier of an overhead structure, the delineator may be omitted. When steel posts are used, they shall be unfinished.

635.04 Installing New Delineator Posts and Reflectors. Only one type of reflector and geometric shape will be permitted within the limits of a contract. The color of the reflectors shall be the same as the adjacent edge line.

For qualification purposes only, three samples required for tests shall be submitted by the Contractor. In addition, the Engineer will select three samples at random from each shipment for acceptance purposes.

Delineator reflectors shall be fastened to the posts with a vandal proof fastener approved by the Engineer.

The posts or brackets shall be vertical and oriented so that the face of the delineator shall be at 90 degrees to the centerline of the adjacent pavement.

Delineators shall be placed both as to lateral placement and height so as to have a satisfactory and uniform alignment. Acceptance of the delineator installation will include, in addition to ordinary inspection, a night inspection from an automobile by the Engineer and the Contractor, or a duly authorized representative. Delineators not having satisfactory and uniform night appearance shall be adjusted at the Contractor's expense until they do conform.

635.05 Removing and Reinstalling Existing Delineator Posts and Reflectors. Existing delineator posts and reflectors shall be removed and reinstalled at the locations and spacings shown on the plans.

Removal shall be performed in a manner that will not cause any damage to the existing posts or reflectors. Any posts or reflectors damaged during the removal shall be replaced by the Contractor with the same type at his/her own expense. When necessary, the existing posts and reflectors shall be stored within the right of way in a manner approved by the Engineer prior to reinstallation.

Reinstallation of the posts and reflectors shall be according to the applicable portions of Article 635.04. All damaged posts and reflectors shall be replaced with new posts and reflectors of the same type and color prior to reinstallation.

635.06 Method of Measurement. This work will be measured for payment in place in units of each.

635.07 Basis of Payment. The work of furnishing and installing new delineator posts and reflectors will be paid for at the contract unit price each for DELINEATORS. No additional compensation will be allowed for two single reflector units placed back to back.

The work of removing and reinstalling existing delineator posts and reflectors will be paid for at the contract unit price each for REMOVE AND REINSTALL DELINEATORS, which price shall include replacing damaged posts and reflectors, except those damaged during removal and required to be replaced by the Contractor at his/her own expense.

SECTION 636. CABLE ROAD GUARD

636.01 Description. This work shall consist of constructing a cable road guard consisting of a steel cable mounted on posts.

636.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Cables and Accessories	1006.26
(b) Wood Posts and Wood Block	1007.01, 1007.02, 1007.07
(c) Steel Posts	1006.04
(d) Preservative Treatment	1007.12
(e) Portland Cement Concrete (Note 1)	1020
(f) Reinforcement Bars	1006.10

Note 1: Concrete shall be Class SI Concrete.

CONSTRUCTION REQUIREMENTS

636.03 General. Cable road guard shall be constructed at the locations and according to the details shown on the plans. Either wood or steel posts shall be used at the option of the Contractor. The posts shall be according to Article 630.05.

End anchor arrangements shall be constructed at the ends of cable road guard. Dead end anchor arrangement shall be used when cable road guard is placed adjacent to a bridge or when conditions will not permit placing the post anchor beyond the end post. When the length of the cable road guard is more than 150 m (500 ft), intermediate anchor arrangements shall be constructed at intervals not exceeding 150 m (500 ft).

Cable splices will be permitted provided that no single piece of unspliced cable is less than 15 m (50 ft). The cable shall be tensioned to the satisfaction of the Engineer.

636.04 Method of Measurement. Cable road guard will be measured for payment in meters (feet) in place from center to center of end posts.

636.05 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for CABLE ROAD GUARD, SINGLE STRAND, which price shall include the concrete, furnishing and installing dummy posts and all anchor arrangements.

SECTION 637. CONCRETE BARRIER

637.01 Description. This work shall consist of constructing a concrete barrier to the lines, grades and details shown on the plans.

637.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Welded Wire Fabric (Note 1)	1006.10
(c) Anchor Bolts (Note 2)	1006.09
(d) Preformed Expansion Joint Filler	1051.01 - 1051.08

Note 1. Fabric shall be 150 mm x 150 mm - 5.7 mm (6 in. x 6 in. - W4 x W4) weighing approximately 2.83 kg/sq m(58 lb/100 sq ft).

Note 2. Anchor bolts shall be Grade 60.

CONSTRUCTION REQUIREMENTS

637.03 General. Concrete Barrier shall be constructed according to the applicable provisions of Sections 503, 504, and 606.

The Contractor shall have the option of using precast or cast-in-place barrier, except that cast-in-place barrier shall be used when the slope of the surface in front of the barrier exceeds four percent.

When the slope of the surface in front of the barrier exceeds four percent, the axis of symmetry for the face of the barrier shall be vertical on the side where the surface slopes toward the barrier and shall be perpendicular to the surface on the side where the surface slopes away from the barrier.

When median lighting is specified, the lighting support section shall be cast-in-place. If precast units are being used, the precast units shall be placed prior to casting the lighting support section.

Where the horizontal alignment of the concrete barrier is curved, the barrier shall be constructed either on the curved alignment or on cords not more than 3 m (10 ft) in length.

In lieu of welded wire fabric reinforcement in the concrete barrier, the Contractor may elect to use four No. 15 (No. 4) deformed horizontal reinforcement bars on 225 mm (9 in.) centers and No. 15 (No. 4) deformed vertical reinforcement bars on 750 mm (2 ft 6 in.) centers. (The vertical bars may be omitted if the wall is slip formed.) The reinforcement bars shall be lappped a minimum of 325 mm (13 in.).

Precast units shall not be removed from the casting beds until a flexural strength of not less than 2,000 kPa (300 psi) or a compressive strength of not less than 10,000 kPa (1400 psi) is attained. Transportation of precast sections to the jobsite will not be allowed until a flexural strength of not less than 4,500 kPa (650 psi) or a compressive strength of not less than 24,000 kPa (3,500 psi) is attained. In no case may precast units be loaded, shipped and used prior to four days after casting.

All precast units shall be firmly butted together in a smooth continuous line.

In the transition section of the precast median barriers, the space between the two single faced sections shall be filled with concrete or subbase granular material, Type C. The cost of the fill shall be included in the pay items for the barrier.

When the transition section between single face and double face barrier is used, the shear groove shall be completely filled with grout as directed by the Engineer after the barrier is in place.

637.04 Slipforming. When slip form methods are used, the machine shall be approved by the Engineer. The dimensions of the barrier shall be within the tolerances shown on the plans. Barriers having dimensions outside the tolerance limits will be rejected and shall be removed and replaced. The vertical centerline of the barrier shall not vary from the proposed centerline alignment by more than 75 mm (3 in.) nor by more than 13 mm (1/2 in.) in 3 m (10 ft). In addition, all surfaces shall be checked with a 3 m (10 ft) straightedge furnished and used by the Contractor as the concrete is extended from the slipform paver.

Barriers having surface irregularities greater than 10 mm (3/8 in.) in 3 m (10 ft) shall be corrected immediately at the Contractor's expense. Continued variations in the barrier surface exceeding 6 mm (1/4 in.) in 3 m (10 ft) will not be permitted and

remedial action shall immediately be taken to correct the problem. Any deformations or bulges remaining after the initial set shall be removed by grinding after the concrete has hardened. The vertical surface at the base of the barrier shall be trowelled true after passage of the slip form machine. All holes and honeycomb shall be patched immediately. The entire surface shall receive a light brush finish before final set.

637.05 Finishing. The surface of concrete barriers shall be finished according to Article 503.16 (a).

637.06 Securing Barrier to Base. Dowel bars used to secure concrete barrier to the base shall be No. 25 (No. 8) deformed reinforcement bars of a length necessary to obtain the minimum embedment shown on the plans. Dowel bars placed in existing portland cement concrete pavement or existing paved median surface shall be set in mortar in drilled holes to the satisfaction of the Engineer.

Precast barrier shall be either dowelled in place or placed on a grout bed. When dowel bars are used, the barrier shall be placed on a bed of dry cement not exceeding 13 mm (1/2 in.) in thickness to achieve proper alignment and seating. Three dowels shall be placed in each precast barrier section. For double face barrier, the dowels shall be staggered side to side. All dowel holes and lifting holes or slots shall be grouted closed to the satisfaction of the Engineer unless otherwise required for drainage of backfill material for single face barrier. When a grout bed is used, the grout shall be placed such that after seating the barrier the grout thickness will be approximately 13 mm (1/2 in.) thick and the continuous shear key will be completely filled. Excess grout shall be cleaned up and removed. Grout shall be composed of one part portland cement to two parts fine aggregate.

For cast-in-place barriers, dowel bars shall be on 1.2 m (4 ft 0 in.) centers and staggered side to side except when a polyethylene bond breaker is used. Dowel bars may be eliminated for new rigid base when the barrier is cast integrally with the base. A 50 mm x 150 mm (2 in. x 6 in.) key way may be cast into new rigid base and used in lieu of dowels.

637.07 Joints. Expansion joints shall be installed in the concrete barrier in prolongation with expansion joints in the adjacent concrete pavement or shoulder and shall be similar in opening to the type of joint adjoining it.

At locations where precast or cast-in-place concrete barrier abuts a rigid structure, a 50 mm (2 in.) thick preformed expansion joint filler conforming to the shape of the barrier shall be installed between the barrier and the structure. Concrete nails or other suitable methods shall be used to hold the expansion joint filler in place.

For cast-in-place barriers, construction joints shall be formed with the use of a smooth header and the reinforcement shall be continuous through the joint. Contraction joints shall be installed at existing contraction or hinge joints in the concrete pavement or shoulder and at uniform intervals with a maximum spacing of 6 m (20 ft). Contraction joints shall be formed by a groove 3 mm (1/8 in.) wide by 50 mm (2 in.) deep either formed in the plastic concrete or sawed after the concrete has set. The reinforcement shall be continuous through all contraction joints.

637.08 Method of Measurement.

- (a) **Contract Quantities.** The requirements for the use of Contract Quantities shall conform to Article 202.07(a).
- (b) **Measured Quantities.** Concrete barrier, single face, and concrete barrier, double face, will be measured for payment in meters (feet) in place, along the centerline of the barrier. The length measured for payment will be the overall length to the limits shown on the plans. Transitions in width from double to single face barrier will be included in the overall length measured for Concrete Barrier, Double Face. The Lighting Support Section will be included in the overall length measured for Concrete Barrier, Double Face. The foundation portion under the Lighting Support Section will not be measured for payment.

637.09 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for CONCRETE BARRIER, DOUBLE FACE or CONCRETE BARRIER, SINGLE FACE.

SECTION 638. GLARE SCREEN

638.01 Description. This work shall consist of constructing glare screens consisting of concrete glare screen, glare screen blades, or modular glare screen blades, mounted on concrete medians.

638.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Glare Screen Blades	1086
(b) Portland Cement Concrete (Note 1)	1020
(c) Reinforcement Bars	1006.10
(d) Modular Glare Screen Blades	1086

Note 1. Concrete shall be Class SI Concrete.

CONSTRUCTION REQUIREMENTS

638.03 Glare Screen Blades. Glare screen blades and modular glare screen blades shall be installed on the concrete barrier according to the details shown on the plans or as directed by the Engineer. Base plate brackets or modules shall be placed true to line and at the spacing and angles shown on the plans. Anchor studs shall be at least 75 mm (3 in.) from any contraction, expansion, or construction joint in the barrier. Base plates shall be firmly attached to the concrete barrier with two expansion anchor studs. Modules shall be firmly attached to the concrete barrier with six expansion anchor studs. Anchor studs shall be secured by tightening the nuts with 34 to 40 N·m (25 to 30 ft lb) of torque.

The Contractor shall load test four percent of all anchor studs in the presence of the Engineer. The equipment and method used shall meet the approval of the Engineer. The minimum test load shall be 18 kN (4000 lb) in direct pull. For each

anchor that fails the test requirement, two more anchor studs, picked by the Engineer, shall be tested. Each anchor stud that fails to meet the test requirement shall be reset, or removed and the hole drilled deeper and reset, and retested until it meets the test requirements.

Glare screen blades shall be placed on the base plate brackets true to line. When in final position, self-tapping screws shall be installed snug against the plastic surface without exceeding a maximum torque of 20 N·m (15 ft lb).

Unless otherwise directed by the Engineer, all construction operations shall be performed on one side of the concrete median barrier. Any damage done to the concrete barrier by the Contractor's operation shall be repaired by and at the expense of the Contractor to the satisfaction of the Engineer.

638.04 Concrete Glare Screen. Concrete glare screen shall be constructed according to the applicable portions of Section 637.

When concrete glare screen is constructed on an existing concrete barrier, the vertical reinforcement bars shall be grouted in place in drilled holes in the barrier to the satisfaction of the Engineer. Joints in the concrete glare screen shall be a continuation of joints in the existing concrete barrier and shall be of the same configurations. In addition, if there is a crack in the barrier that is working as a joint, a joint shall be placed over it in the glare screen and the reinforcement shall be cut.

When concrete glare screen is constructed on new concrete barrier, it may be constructed integrally with the barrier. Joints in the glare screen shall be according to Article 637.07.

638.05 Method of Measurement. The various heights of glare screen blades will be measured for payment in units of each blade complete in place.

Concrete glare screen will be measured for payment in meters (feet) in place, measured along the centerline of the concrete glare screen.

Modular blade-type glare screen will be measured for payment in meters (feet) in place, measured along the centerline of the modular blade-type screen.

638.06 Basis of Payment. Glare screen blades will be paid for at the contract unit price each for GLARE SCREEN BLADES, of the height specified.

Modular blade-type glare screens will be paid at the contract unit price per meter (foot) for MODULAR BLADE-TYPE GLARE SCREENS.

The work of constructing concrete glare screen will be paid for at the contract unit price per meter (foot) for CONCRETE GLARE SCREEN.

SECTION 639. PRECAST PRESTRESSED CONCRETE SIGHT SCREEN

639.01 Description. This work shall consist of furnishing and installing a precast prestressed concrete panel wall sight screen.

639.02 Materials. Materials shall be according to the following Articles of Section 1000:

Item	Article/Section
(a) Galvanized Steel plates (Note 1)	1006.04
(b) Galvanized Bolts and Washers	1006.27(f)
(c) Prestressing Steel (Note 2)	1006.10(d)
(d) Coarse Aggregate	1004

Note 1: Threaded inserts shall be galvanized steel capable of developing the shear strength of the bolts by which they are engaged and shall be approved by the Engineer.

Note 2: The steel shall be Grade 270, have a diameter of 10 mm (3/8 in.) and have a minimum cross sectional area of 55 sq mm (0.085 sq in.).

CONSTRUCTION REQUIREMENTS

639.03 General. The sight screen shall be as shown on the plans and according to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, Traffic Signals, and AASHTO Standard Specifications for Highway Bridges. The earth upon which the base of each panel rests shall be firm and level for the entire width of the panel. Excavated material which is clean and free of organic content, or sand, may be used to even out deviations from the horizontal grade at the bottom of the excavation. The bottom of the excavation shall be compacted sufficiently to prevent unequal settlement of the panels as they are set in place.

639.04 Backfill. Backfill shall be coarse aggregate and shall be thoroughly compacted around the base of the wall using a mechanical tamper approved by the Engineer.

639.05 Lifting Devices. The type, number, and locations of lifting devices and the method of handling the precast prestressed panels shall be determined by the fabricator and approved by the Engineer. Portions of the lifting devices which project beyond the surface of the panel shall be sawed or burned off after erection. Lifting devices shall not be located in the surface of the panel facing toward the road.

639.06 Fabrication. The fabrication of the precast prestressed panels shall be according to the applicable portions of Section 504 except for the following:

- (a) The minimum 28 day compressive strength, and the strength at the time of transfer of prestress, of the concrete, shall be 24,100 kPa (3,500 psi) and 15,500 kPa (2,250 psi), respectively.
- (b) One standard 150 x 300 mm (6 x 12 in.) test cylinder shall be made for each 1.5 cu m (2 cu yd) of concrete used in the panels, with a minimum of six cylinders to be made from the concrete used to fabricate the panels on each prestressing bed.

639.07 Method of Measurement. The concrete wall will be measured for payment in meters (feet). The overall length will be measured along the longitudinal axis of the wall from the extreme ends of the end panels.

639.08 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for SIGHT SCREEN (PRECAST PRESTRESSED CONCRETE PANEL WALL), of the height specified.

SECTION 640. CHAIN LINK FENCE SIGHT SCREEN

640.01 Description. This work shall consist of furnishing and installing a chain link fence sight screen.

640.02 Materials. The steel posts shall be galvanized according to ASTM A 53. Structural steel tubing shall be according to ASTM A 501 and shall be galvanized according to AASHTO M 111. Fabric ties, fittings, bolts, nuts, and all other hardware shall conform to the applicable portions of Article 1006.27.

The top and middle brace rails shall be steel pipe 41 mm (1 5/8 in.) outside diameter, mass (weight) of 3.30 kg/m (2.27 lb/ft) and galvanized according to ASTM A 53.

Wood privacy slats shall be 8 mm or 10 mm x 60 mm (5/16 in. or 3/8 in. x 2 3/8 in.) and shall be factory installed. The slats shall be untreated redwood or cedar or treated timber of an approved alternate treated according to Article 1007.12. The slats shall be sound without decay or rot, containing no knot holes larger than one-half the width of the slat.

Steel chain link fabric shall be zinc-coated steel fabric or aluminum-coated steel fabric according to Article 1006.27. The fabric shall be 3.76 mm (#9) gage wire woven in 89 mm x 125 mm (3 1/2 in. x 5 in.) mesh with the top and bottom selvages knuckled.

Zinc-coated or aluminum-coated metal slats of 0.5 mm (#26 gage) steel strip, 70 mm (2 3/4 in.) minimum width, shall be inserted into the chain link fabric, as shown on the plans, after the fabric is mounted against the posts. The zinc coating shall be according to ASTM A 525M (A 525) coating designation G 90. The aluminum coating shall conform to ASTM A 463 coating designation TI 40. The coating on the slats shall be the same type as on the fabric.

Chain link fabric shall be attached to pull posts using minimum 6 x 20 mm (1/4 in. x 3/4 in.) flat stretcher bars and 2.69 mm (#12 gage) by 25 mm (1 in.) wide stretcher bar bands with 10 mm (3/8 in.) diameter carriage bolts. Stretcher bars, stretcher bar bands, and carriage bolts shall be according to Article 1006.27.

Tension cable shall be 10 mm (3/8 in.) diameter, 1 x 7 steel strand with 48 kN (10,800 lb) minimum breaking strength according to ASTM A 475 with Class B galvanized coating. Cable clamps and turnbuckles for use with tension cable shall be galvanized steel, be adequate to develop the full strength of the cable, and be approved by the Engineer.

Truss rods shall be 10 mm (3/8 in.) diameter and be provided with turnbuckles or some other suitable means of adjustment, and conform to Article 1006.26(c).

CONSTRUCTION REQUIREMENTS

640.03 General. The sight screen shall be as shown on the plans and according to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

Pull posts shall be spaced as follows:

- (a) 70 m (240 ft) maximum centers for 1.8 m (6 ft) fence
- (b) 60 m (200 ft) maximum centers for 2.4 m (8 ft) fence
- (c) 48 m (160 ft) maximum centers for 3.0 m (10 ft) fence

All posts shall be set in foundations of Class SI concrete of the depth and diameter shown on the plans.

Chain link fence construction shall be according to Section 664.

The chain link fabric shall be installed on the side of the posts facing toward the road, so the line posts and brace rails are hidden from the view of passing motorists.

640.04 Grounding. Continuous fence shall be grounded at intervals not exceeding 150 m (500 ft) in urban areas and 300 m (1,000 ft) in rural areas.

Fence under a power line shall be grounded by three grounds, one directly under the crossing and one on each side, 7.5 to 15 m (25 to 50 ft) away. A single ground shall be located directly under each telephone wire or cable crossing.

The ground wire shall be connected to the fabric and the ground rod by a mechanical clamp of a cast bronze body and bronze or stainless steel bolts and washers. The bottom connection of the ground wire shall be made to the tension cable.

640.05 Method of Measurement. Chain link fence sight screen will be measured for payment in meters (feet), along the top of the fence from center to center of the end posts.

640.06 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for SIGHT SCREEN (CHAIN LINK FENCE) of the height specified.

SECTION 641. WOOD FENCE SIGHT SCREEN

641.01 Description. This work shall consist of furnishing and installing wood fence sight screen.

641.02 Materials. Bolts and washers shall be according to Article 1006.17.

Nails shall be galvanized common wire nails.

All lumber shall be sound and free from excessive splitting or deterioration. Dimensions shown on the plans are for surfaced (S4S) lumber. Rough sawn lumber of the nominal size shown may be used for any members provided it can be successfully stress graded and pieces of the same nominal size are sawn to a uniform width and thickness.

The required grade of lumber is visually stress graded according to the rules of the following agencies:

- (a) Douglas Fir & Western Red Cedar - West Coast Lumber Inspection Bureau
- (b) Southern Pine-Southern Pine Inspection Bureau
- (c) Red (Swamp) Cypress-National Hardwood Lumber Association

The grades shown below in the table are the minimum acceptable and all species shown are alternates for the indicated usage.

All wood, except Red (Swamp) Cypress and Western Red Cedar, used for posts, rails, or planks, shall be treated with ACA or CCA according to Article 1007.12 except the retention shall be specified in the following table:

Fence Height	Usage Mm (in.)	Lumber Species	Commercial Grade	Preservative Retention kg/cu m (lb/cu ft)	
1.8 m (6 ft) or 2.4 m (8 ft)	Rails 75 x 100 (3 x 4)	Douglas Fir Southern Pine	No.2 No. 1/D	6.41 6.41	(0.40) (0.40)
	Posts 150 x 200 (6 x 8) or 200 x 200 (8 x 8)	Douglas Fir	No. 2	9.61	(0.60)
		Southern Pine	No. 1/D	9.61	(0.60)
	Planks	Red (Swamp) Cypress Southern Pine Western Red Cedar	No. 2 No. 1/D No. 1 Fencing	6.41	NA (0.40) NA

CONSTRUCTION REQUIREMENTS

641.03 General. The sight screen shall be as shown on the plans and according to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaire and Traffic Signals, AASHTO Standard Specifications for Highway

Bridges. Wooden fence construction shall conform to the applicable portions of Section 507.

All fencing for any one installation shall be of the Wood Plank, Type P, or the Cedar Stockade, Type S. The two types shall not be mixed together.

Cedar pickets shall be either split or round, be completely stripped of bark, and be straight and free of excessive taper or bowing, and when installed, shall butt tightly against one another. There shall be no gaps greater than 6 mm (1/4 in.) in width between adjacent pickets.

Fence panels, consisting of horizontal rails and wood planks or cedar pickets, may be prefabricated or built in place. Additional nails, not shown on the plans, may be used to temporarily tack members in place during erection.

Nailing shall be done in such a manner as to avoid splitting the lumber. Lumber which, in the opinion of the Engineer, is split excessively, will be rejected.

641.04 Backfill. The backfill for posts shall be CA 6, CA 10, or CA 12 aggregate according to Article 1004.01. Backfill shall be thoroughly compacted, meeting the approval of the Engineer.

641.05 Method of Measurement. Wooden fence will be measured for payment in meter (feet), along the top of the fence from center to center of end posts.

641.06 Basis of Payment. This work will be paid for at the contract unit price per meters (foot) for SIGHT SCREEN (WOODEN FENCE), of the type and height specified.

OTHER ITEMS

SECTION 660. RESERVED

SECTION 661. BITUMINOUS SHOULDER CURB

661.01 Description. This work shall consist of the construction of bituminous curb along the outer edge of bituminous shoulders.

661.02 Materials. All materials shall meet the requirements of Article 406.02 with the following exceptions:

- (a) Only Class I Surface mixtures C or D shall be used.
- (b) Composition limits by weight shall be as follows:

Passing 12.5 mm (1/2 in.) sieve, ret'd 2.0 mm (No. 10) sieve	20-70%
Passing 2.0 mm (No. 10) sieve, ret'd 75 µm (No. 200) sieve	20-48%
Passing 75 µm (No. 200) sieve	3-9%

Bitumen (Note 1) 3.5-9%

Note 1. The bituminous material shall be PG58-22 or PG64-22 as directed by the Engineer.

CONSTRUCTION REQUIREMENTS

661.03 General. The temperature of the base on which the curb is placed shall not be less than 4 °C (40 °F) at the time the curb is placed. Prior to placing the curb, the base shall be cleaned and then primed with bituminous material selected from the table in Article 406.02 at a rate of 0.2 to 0.5 L/sq m(0.05 to 0.1 gal. per sq yd.).

The bituminous shoulder curb shall be constructed with a mechanical curb laying machine of a type approved by the Engineer. Prior to constructing the curb, additional shoulder shall be constructed according to the details shown on the plans. After the curb is constructed, a liberal application of asphalt seal coat shall be applied uniformly to all exposed curb surfaces by spraying or brushing at a rate satisfactory to the Engineer. The seal coat may be any emulsified asphalt, asphalt cement, rapid curing cutback asphalt, or medium curing cutback asphalt.

661.04 Method of Measurement. The bituminous shoulder curb will be measured for payment in meters (feet) along the face of the curb in place. No deduction in length will be made for any drainage structures installed in the curbing.

661.05 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for BITUMINOUS SHOULDER CURB, which price shall include the additional shoulder under the curb, priming the base prior to placement and sealing the curb after completion.

SECTION 662. CONCRETE SHOULDER CURB

662.01 Description. This work shall consist of the construction of concrete curb along the outer edge of portland cement concrete shoulders.

662.02 Materials. Materials shall be according to the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete (Note 1)	1020
(b) Protective Coat	1023.01
(c) Poured Joint Sealer	1050

Note 1. Concrete shall be Class SH Concrete.

CONSTRUCTION REQUIREMENTS

662.03 General. Concrete shoulder curb shall be constructed according to the details shown on the plans and the applicable portions of Section 483. The

concrete shoulder curb shall be constructed integrally with the portland cement concrete shoulder. Joints in the shoulder shall be continued through the curb and shall be sealed according to Article 483.07.

662.04 Method of Measurement. Concrete shoulder curb will be measured for payment in meters (feet) in place along the face of the curb. No deduction in length will be made, for any drainage structures installed in the curb.

Protective coat, if required, will not be measured for payment.

662.05 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for CONCRETE SHOULDER CURB, which price shall include sawing and sealing the joints and applying the protective coat when required.

SECTION 663. CALCIUM CHLORIDE APPLIED

663.01 Description. This work shall consist of furnishing and applying calcium chloride.

663.02 Materials. Materials shall be according to the following Article of Section 1000 - Materials:

Item	Article/Section
(a) Calcium Chloride	1013.01

Calcium chloride may be Type S (solid) or Type L (liquid). Type S may be Grade 1 (77%), Grade 2 (90%), or Grade 3 (94%). Type L may have anhydrous chloride contents of 30 to 45%.

CONSTRUCTION REQUIREMENTS

663.03 General. The rate of application per square meter (square yard) and the quantity shown in the contract is based on the amount of anhydrous chloride to be applied. The actual application rate shall be the rate shown in the contract divided by the decimal equivalent of the percent anhydrous chloride.

663.04 Method of Measurement. Calcium Chloride Applied will be measured for payment by mass (weight) in metric tons (tons).

The quantity of calcium chloride for which payment will be made will be the total mass (weight) multiplied by the decimal equivalent of the percent of anhydrous chloride.

663.05 Basis of Payment. This work will be paid for at the contract unit price per metric ton (ton) for CALCIUM CHLORIDE APPLIED.

When it is specified that the calcium chloride is to be mixed with aggregate, the cost of mixing shall be included in the type of work performed.

SECTION 664. CHAIN LINK FENCE

664.01 Description. This work shall consist of constructing a chain link fence.

664.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Chain-Link Fabric	1006.27
(b) Line Posts (Steel Pipe, Structural Shapes and Roll Formed Sections)	1006.27
(c) Terminal Posts (End, Corner or Pull)	1006.27
(d) Gate Posts	1006.27
(e) Tension Wire	1006.27
(f) Horizontal Braces	1006.27
(g) Truss Rods	1006.26
(h) Gate Frames	1006.27
(i) Post Tops	1006.28
(j) Stretcher Bars (Note 1)	1006.27
(k) Fabric Ties	1006.27
(l) Fittings	1006.27
(m) Bolts and Nuts	1006.27
(n) Barbed Wire	1006.28

Note 1. Stretcher bars shall be galvanized flat steel bar not less than 6 mm x 19 mm (1/4 in. x 3/4 in.) and the stretcher bar bands shall be galvanized flat steel bar not less than 3 mm x 25 mm (1/8 in. x 1 in.) with an M10 (3/8 in.) galvanized carriage bolt.

CONSTRUCTION REQUIREMENTS

664.03 General. At locations of small natural or drainage ditches where it is not practical to conform the fence to the general contour of the ground surface, the Contractor, when directed, shall span the opening below the fence with barbed wire fastened to stakes of such length as required. The new fence shall be permanently tied to the terminals of existing fences whenever required by the Engineer. The finished fence shall be plumb, taut, true to line and ground contour, and complete in every detail. Where directed, the Contractor will be required to stake down the chain link fence at several points between posts.

664.04 Installing Posts. Posts shall be properly spaced and set in Class SI Concrete conforming to the applicable portions of Section 1020 except if the concrete is mixed in truck mixers or transported in agitating trucks, the time limit for unloading it may be extended to 120 minutes by the Engineer. Wherever right of way markers are omitted, the posts shall be set with back of post flush with the right of way line.

On terminal (end, corner, pull, brace) and gate posts, the post tops where required and brace rail clamps around the posts shall be placed before setting the posts in concrete bases. In setting the gate posts, great care shall be taken to make sure that gate posts are set the exact distance apart as shown on the plans. A line drawn across from the top of one gate post to the other shall be level, regardless of

the grade at the ground line. If the ground is not level, the upgrade post shall be set first to get the proper height for the downgrade post. Fence shall not be erected until the concrete encasement around the posts has cured for at least seven days. Stretcher bar bands and truss bands as called for on the plans shall be spread and slipped on end, corner, pull, brace and gate posts as the next operation. Post tops shall then be installed on all other posts where required.

664.05 Post Tops. All hollow pipe and tube type posts shall be fitted with post tops. The bases of the post tops shall have flanges which fit around the outside of the posts and shall be secured in place.

664.06 Tension Wire. Tension wires shall be used in the erection of chain link fence. The top and bottom tension wire shall be placed, stretched taut, and secured at ends to all posts in a satisfactory manner before fabric is placed. Tension wire shall be stretched tight with galvanized turn buckles spaced at intervals of not more than 300 m (1000 ft).

664.07 Braces. When required by the plans, braces shall be placed 300 mm (12 in.) down from the top of the terminal posts and shall extend from the terminal (end, corner and pull) posts and gate posts to the brace posts. The braces shall be securely fastened to the post and trussed from brace post back to terminal posts with 10 mm (3/8 in.) round rods with a turnbuckle.

664.08 Fabric. The fabric shall be unrolled on the outside of the fence line with the bottom edge of the fabric against the posts. The various rolls shall be spliced by bringing the ends close together and weaving in a picket in such a way that it will engage both of the roll ends and catch with each twist each separate mesh of the end pickets of both rolls of fabric.

At end, corner or gate posts, the stretcher bar shall be slipped through the end picket of the fabric and the stretcher bar bands at the same time. Then the bolts in the stretcher bar bands shall be tightened. Additional rolls of fabric shall be spliced and placed as the erection progresses along the fence. In long sections, the fence shall be stretched at intervals of about 30 m (100 ft). The fabric shall be placed by securing one end and applying sufficient tension to remove all slack before making attachments elsewhere. After the fabric has been stretched, it shall be tied to the tension wire with fabric ties spaced not more than 600 mm (24 in.) apart. The fabric shall then be attached to the line posts with fabric ties spaced not more than 355 mm (14 in.) apart. The topmost clip shall be placed on the line post as near the top of the fabric as possible and the lowest clip as near the bottom of the fabric as possible. At terminal (end, corner and pull) and gate posts, the fabric shall be fastened with stretcher bars and bands. The fastenings shall be spaced not more than 355 mm (14 in.) on centers for terminal (end, corner and pull) and gate posts. The topmost band shall be placed on these posts as near the top of the fabric as possible and the lowest band as near the bottom as possible.

Standard chain link fence stretching equipment shall be provided for stretching the fabric before tying it to the tension wire and posts. The stretching and tying operations shall be repeated about every 30 m (100 ft) until the run of fence is completed.

Before making a closure, the other end of the run shall be fastened to the end, corner or gate post as described previously. The operation of making a closure of a run shall be as follows: The stretching equipment shall be clamped on the ends of the fabric parallel to each other and about 1.5 m (5 ft) apart when the tension is first applied. The stretching shall continue until the slack has been removed from both sections of the fabric. If the ends overlap, the fabric shall be cut to match. The ends shall be joined by the insertion of a picket similar to the methods of connecting two rolls of fabric.

664.09 Gates. The gates shall be hung on gate fittings as shown on the plans. The lower hinge (ball and socket type) shall be placed on top of the concrete in which the gate post is set. The sockets for the cane or foot bolts shall be set in concrete so that the plunger pin will fit perfectly in the socket when the gate is in a closed position. Gates shall be so erected as to swing in the direction indicated and shall be provided with gate stops as specified or shown on the plans. Gate keepers shall be provided to hold gates when in open position, and shall be located and installed as directed by the Engineer. Gates shall be erected in suitable places as directed by the Engineer or as shown on the plans. All hardware shall be thoroughly secured, properly adjusted and left in perfect working order. Hinges and diagonal bracing in gates shall be adjusted so that gates will hang level.

664.10 Existing Fence Connections. Wherever a new fence joins an existing fence, either at a corner or at the intersection of straight line fences, a corner post with brace post shall be set at the junction and braced the same as described for corner posts or as shown on the plans.

If the connection is made at other than the corner of the new fence, the last span of the old fence shall contain a brace span.

664.11 Protective Electrical Ground. Continuous fence shall be grounded at intervals not exceeding 150 m (500 ft) in urban areas and 300 m (1000 ft) in rural areas. There shall be a ground within 30 m (100 ft) of gates in each section of the fence adjacent to the gate.

Fence under a power line shall be grounded by three grounds, one directly under the crossing and one on each side 7.5 m (25 ft) to 15.0 m (50 ft) away. A single ground shall be located directly under each telephone wire or cable crossing.

The counterpoise ground shall be used only where it is impossible to drive a ground rod.

The ground wire shall be connected to the fabric and the ground rod by a mechanical clamp of cast bronze body and bronze or stainless steel bolts and washers.

664.12 Method of Measurement. Chain Link Fence will be measured for payment in meters (feet), along the top of the fence from center to center of end posts, excluding the length occupied by gates.

664.13 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for CHAIN LINK FENCE, and at the contract unit price each for CHAIN LINK GATES, of the opening sizes and types specified, which prices shall

include payment for all excavation and backfilling except excavation in rock which will be paid for according to Section 502 for Rock Excavation for Structures.

The contract unit price for Chain Link Fence shall also include furnishing all materials and installing the complete fence, except gate posts, gates, fittings and accessories for the gates, and shall include clearing, encasing the posts with concrete, and furnishing and installing protective electrical grounds.

The contract unit price for Chain Link Gates shall also include furnishing all materials and installing the complete gates including the gate posts and fittings and accessories for the gates and gate posts, and clearing and encasing the posts with concrete.

SECTION 665. WOVEN WIRE FENCE

665.01 Description. This work shall consist of constructing a combination woven wire and barbed wire fencing supported on either wood or metal posts, including gates and accessories.

665.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Woven Wire Fencing	1006.28
(b) Barbed Wire	1006.28
(c) Wood Posts	1007.11
(d) Wood Braces and Blocks	1007.11
(e) Brace Wires	1006.28
(f) Metal Posts	1006.28
(g) Metal Braces	1006.28
(h) Gate Frames	1006.28
(i) Fittings and Miscellaneous Materials	1006.28
(j) Bolts and Nuts	1006.27

CONSTRUCTION REQUIREMENTS

665.03 General. Posts shall be set vertical and in true alignment. The new fence shall be permanently tied to the terminals of existing fences when required by the Engineer.

Metal corner, end, pull posts and braces shall be properly spaced and set in Class SI Concrete conforming to the applicable portions of Section 1020, except that if the concrete is mixed in truck mixers or transported in agitator trucks, the time limit for unloading it may be extended to 120 minutes by the Engineer. Metal line posts may be driven in place.

All wood posts shall be set according to Article 634.05.

Any high points which interfere with the placing of woven wire shall be graded to provide the clearance shown on the plans.

Barbed and woven wire shall be pulled tight, according to standard practice and the recommendations of the manufacturer, and shall be fastened to wood posts by means of 40 mm (1 1/2 in.) minimum galvanized fence staples and to metal posts by means of wire, clips or other suitable fasteners. Splicing barbed or woven wire shall be accomplished by using either a wrapped splice or a corrosive resistant, compressed sleeve type splice meeting the approval of the Engineer. When a wrapped splice is used for woven wire, the vertical wires adjacent to the ends shall be brought together and the end of each horizontal wire wrapped not less than six complete turns around the other corresponding horizontal wire. When barbed wire is spliced, each end shall be wrapped not less than six complete turns around the other wire.

Gates shall be assembled and installed according to the details shown on the plans. Vehicle gates shall swing open 180 degrees. Pedestrian gates shall swing open 90 degrees. Gate keepers shall be provided to hold gates when in an open position and shall be located and installed as directed by the Engineer.

Continuous fence shall be grounded at intervals not exceeding 60 m (200 ft). There shall be a ground not exceeding 10.7 m (35 ft) from a gate in each section of the fence adjacent to a gate. There shall be a minimum of one ground in any partial section of fence, constructed separately but in conjunction with main fence.

Fence under a power line shall be grounded by three grounds, one directly under the crossing and one on each side 8 m (25 ft) to 10.7 m (35 ft) away. A single ground shall be placed directly under each telephone wire or cable crossing. Each barbed wire and the top and bottom wires of the woven fence shall be fastened to the metal post by a mechanical means to assure a tight connection for positive grounding. When metal line posts are used in lieu of wood line posts, this grounding is not required.

665.04 Method of Measurement. Woven wire fence will be measured for payment in meters (feet) along the top of the fence from center to center of end posts, excluding the length occupied by gates.

665.05 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for WOVEN WIRE FENCE, and at the contract unit price each for WOVEN WIRE GATES, of the sizes and types specified, which prices shall include all excavation and backfilling, except excavation in rock which will be paid for according to Section 502 for Rock Excavation for Structures.

The contract unit price for woven wire fence shall also include furnishing and installing the complete fence except gate posts, gates, and fittings and accessories for the gate, and for clearing, encasing the posts with concrete, and furnishing and installing protective electrical grounds.

The contract unit price for Woven Wire Gates shall also include furnishing and installing the complete gates including the gate posts and fittings and accessories for the gates and gate posts, and clearing and encasing the posts with concrete.

SECTION 666. RIGHT OF WAY MARKERS

666.01 Description. This work shall consist of furnishing and erecting concrete right of way markers, or removing and reerecting right of way markers.

666.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Reinforcement Bars	1006.10

CONSTRUCTION REQUIREMENTS

666.03 Furnishing and Erecting. Right of way markers shall be precast of Class SI Concrete according to the designs shown on the plans.

Right of way markers shall not be erected within the corporate limits of cities, villages or towns. When erected within improved residential areas, Method B right of way markers shall be used. Method A right of way markers shall be used at all other locations as shown on the plans.

Right of way markers shall be set so the back of the post is flush with the right of way line, except when the marker conflicts with a property pin, in which case the right of way marker shall be offset. The markers shall be set in compacted soil, and the bottom of the holes shall be rammed to provide a stable foundation. They shall be set in a vertical position with the lettered side facing the roadbed. The holes shall be backfilled and thoroughly compacted with approved materials in layers in such manner that the bottom of the markers will remain in the correct position.

Right of way markers shall be erected before any grading operations are started, except that markers in easement areas may be erected after the final grading is complete.

666.04 Removing and Reerecting. Existing right of way markers designated to be removed and reerected shall be removed in a manner that will not damage the marker. Any marker damaged during removal shall be replaced with a new marker by the Contractor at his/her expense. Holes shall be backfilled as directed by the Engineer.

The existing right of way markers shall be reerected at the locations shown on the plans. Reerecting of existing right of way markers shall be according to Article 666.03. Existing markers damaged during removal or otherwise considered unsatisfactory for reuse shall be replaced with new markers before reerecting.

666.05 Basis of Payment. Furnishing and erecting right of way markers will be paid for at the contract unit price each for FURNISHING AND ERECTING RIGHT OF WAY MARKERS, which price shall include furnishing the markers and of all excavation and backfill, except excavation in rock.

Art. 667.01 Drainage Markers And Permanent Survey Markers

The work of removing and reerecting existing right of way markers will be paid for at the contract unit price each for REERECTING RIGHT OF WAY MARKERS, which price shall include removing the existing markers, replacing unsatisfactory markers with new markers except those damaged during removal and required to be replaced by the Contractor at his/her own expense, and all excavation and backfill except excavation in rock.

Excavation in rock will be paid for according to Section 502 for Rock Excavation for structures.

SECTION 667. DRAINAGE MARKERS AND PERMANENT SURVEY MARKERS

667.01 Description. This work shall consist of furnishing and erecting drainage markers or furnishing and installing permanent survey markers.

667.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Reinforcement Bars	1006.10

CONSTRUCTION REQUIREMENTS

667.03 Drainage Markers. Drainage markers shall be precast of Class SI Concrete according to the design shown on the plans.

Drainage markers shall be placed at the right of way line at the locations shown on the plans or where directed by the Engineer. They shall be erected according to Article 666.03. The reference in Article 666.03 to right of way markers shall be construed to include drainage markers.

667.04 Permanent Survey Markers. Except where it is necessary to install the bronze tablet in an existing rock ledge, concrete pavement or a structure, the markers shall be either precast or cast in place at the option of the Contractor. Class SI Concrete shall be used throughout.

The location of the markers shall be according to the plans. The markers shall be placed at the P.T.'s and P.C.'s of horizontal curves and spaced along the tangents such that a minimum of two markers are always inter-visible.

The markers shall be placed under the direction of the Engineer and shall be installed in such a manner that there will be no future settlement or horizontal shifting. The monuments shall be placed in a way that the survey point will fall within the portion of the tablet provided for that purpose.

The project designation, the centerline station, the survey point, and the elevation shall be permanently marked on the tablet by the use of metal dies after the marker has been installed.

667.05 Basis of Payment. The work of furnishing and erecting drainage markers will be paid for at the contract unit price each for FURNISHING AND ERECTING DRAINAGE MARKERS, which price shall include furnishing the markers and all excavation and backfill, except excavation in rock.

The work of furnishing and installing permanent survey markers will be paid for at the contract unit price each for PERMANENT SURVEY MARKERS, of the type specified, which price shall include furnishing the markers, either precast, cast in place, or drilled and set in existing ledge rock, concrete pavement or a structure, and permanently marking the tablet and all excavation and backfill except excavation in rock.

Excavation in rock will be paid for according to Section 502 for Rock Excavation for Structures.

SECTION 668. PRESERVATION OF STONES AND OTHER MARKERS

668.01 Description. This work shall consist of preserving Section or Subsection Stones and other markers.

CONSTRUCTION REQUIREMENTS

668.02 General. All stones and other markers encountered in the field shall be cross-tied prior to construction operations. This work shall be done by an Illinois Professional Land Surveyor. The Illinois Professional Land Surveyor shall reference the exact location of the existing monument, supervise the resetting of the monument, and prepare a monument record. The new monument record shall be filed in the County Recorder of Deeds at the County Court House in the County involved and a copy of the filed monument record shall be supplied to the District Chief of Surveys.

668.03 Basis of Payment. This work will be paid for according to Article 109.04.

SECTION 669 REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES

669.01 Description. This work shall consist of the removal and proper disposal of contaminated soil, water and/or underground storage tanks (UST), content, and associated underground piping to the point where the piping is above the ground, including determining the content types and estimated quantities.

669.02 Equipment. All equipment shall comply with OSHA and API guidelines. Decontamination shall be performed on all equipment as appropriate to the regulated substance and degree of contamination according to OSHA and API guidelines. All cleaning fluids used to decontaminate the tank and/or equipment shall be treated as the contaminant unless laboratory testing proves otherwise.

The Contractor shall furnish, in a clean condition, all equipment used for purposes of excavation, temporary storage, and transportation of material classified as non-special waste, non-hazardous special waste, or hazardous waste. Clean

condition means the equipment does not contain any residual material classified as a non-special waste, non-hazardous special waste, or hazardous waste. Residual materials include, but are not limited to, petroleum products, chemical products, sludges, or any other material present in or on equipment.

The Contractor shall notify the Engineer of the delivery of all excavation, storage, and transportation equipment to a work area location. Before beginning any associated soils management activity, the Contractor shall provide the Engineer with the opportunity to inspect the equipment. The Engineer shall approve the use of the equipment at the time of the visual inspection. The Engineer shall require the equipment to be decontaminated, if the equipment contains contaminated residual material.

669.03 Qualifications. The Contractor or subcontractor shall be a qualified environmental firm approved by the Engineer and District Environmental Coordinator. If the project includes an underground storage tank, the Contractor or subcontractor shall be licensed and certified with the Office of the State Fire Marshall (OSFM) and shall possess all permits required to perform the work described in the plans and specifications.

669.04 Contractor Requirements. The Contractor shall file a written Site Contamination Operation Plan, Site Health and Safety Plan, and Erosion Control Plan applicable for all personnel working on the project. The Site Health and Safety Plan shall pertain to any visitors or State employees at the site. The Contractor shall submit monthly or quarterly reports and a final technical report to the Engineer.

The Contractor shall provide a State certified manifest to the Engineer for the transport and disposal of all non-hazardous special waste (hereafter referred to as special waste) or hazardous waste and the removed UST.

The Contractor shall contact the local OSFM's office in writing at least 30 days prior to starting the excavation to remove any UST(s). The Contractor shall also contact the Engineer and the local OSFM's office at least 72 hours prior to removal to confirm the OSFM inspector's presence during the UST removal. Removal, transport, and disposal of the UST shall be according to the applicable portions of the latest revision of the "American Petroleum Institute (API) Recommended Practice 1604".

CONSTRUCTION REQUIREMENTS

669.05 Site Contamination Operation Plan. The Contractor shall develop a project specific Site Contamination Operation Plan and submit the plan to the Engineer a minimum of two weeks before beginning construction activities. The plan shall outline the procedures used to mobilize all required subcontractors in a timely fashion, and provisions to continue work in areas determined to be contaminated. The plan shall also meet all requirements for the removal and disposal of non-special waste, special waste, or hazardous waste.

The Site Contamination Operation Plan shall provide a list of all proposed subcontractors, indicating the service each is to provide. The Contractor and subcontractors shall provide a Statement of Qualifications demonstrating their capabilities to provide services as indicated in the Site Contamination Operation Plan.

669.06 Site Health and Safety Plan. The Contractor shall develop a project specific Health and Safety Plan and submit the plan to the Engineer a minimum of two weeks before beginning construction activities.

The plan shall specify procedures and equipment to protect site workers and observers from hazards encountered during activities in locations containing contaminated material. A qualified industrial hygienist or health and safety specialist shall prepare the Health and Safety Plan. The Contractor's Corporate Officer responsible for worker health and safety shall approve and sign the plan before submittal to the Department.

A qualified industrial hygienist is defined as having a minimum of five years of experience in the industrial hygiene field, an academic degree in a related science field, and successful completion of two days of testing presented by the American Board of Industrial Hygiene. A Certified Industrial Hygienist (CIH) meets the above definition.

A qualified Health and Safety Specialist is defined as having a minimum of three years experience in hazardous waste operations, familiar with applicable health and safety procedures and protocols, and holds current training status according to 29 CFR 1910.120. This person may be a Certified Safety Professional (CSP) or an Illinois Registered Professional Engineer. A CSP has a minimum of four years of professional safety experience, has a baccalaureate degree in safety, and has successfully completed the Safety Fundamentals examination and subsequent Specialty Examination presented by the Board of Certified Safety Professionals.

The Contractor's Corporate Officer responsible for the contractor's health and safety program and approval of the Health and Safety Plan shall be able to identify hazards; assess employee exposure and risk; have knowledge of OSHA standards, hazards correction techniques and practices, work place safety, and health program requirements. This person shall also be able to effectively communicate this knowledge both orally and in writing or contract for these abilities with a qualified Industrial Hygienist or Health and Safety Specialist.

The responsibility for the implementation and enforcement of all health and safety requirements lies solely with the Contractor. The Contractor shall take all necessary precautions for the safety of, and provide the necessary protection to prevent damage, injury or loss to construction personnel performing work within the Exclusion and Decontamination Zones. The Contractor shall ensure all workers involved in any activities within the contaminated locations or associated with the contaminated materials are conversant with all the requirements of the Health and Safety Plan and have signed off and dated personal acknowledgment of the plan. The Contractor shall post copies of the plan at various locations throughout the work area to facilitate spontaneous review.

Any delays in work start-up or down time that are the result of Contractor time requirements for performing amendments to the Health and Safety Plan or Contractor inability to comply with EPA and/or OSHA safety and health regulations will not be compensated by the Department if the Department determines the Contractor did not adhere to the requirements as stated in these specifications.

- (a) Zones. Three distinct zones (exclusion, decontamination, and support) shall divide the affected portions of the project.
- (1) Exclusion Zones are the areas where contamination does or could occur. These zones have the highest inhalation exposure potential and/or a high probability of skin contact with potential contaminants/contaminated material. The Exclusion Zone designation shall remain until the entire excavated area has been completely backfilled. The Contractor shall ensure that neither their employees nor subcontractors execute maintenance nor repair operations on equipment located in the Exclusion Zone.
 - (2) Decontamination Zones are areas established to prevent the transfer of contaminants outside the Exclusion Zones. This zone eliminates the possibility of the physical transfer of contaminating substances on people, equipment, or in the air to unregulated areas. A combination of decontamination, distance from active work areas, zone restrictions, and work function shall eliminate the possibility of physical transfer of contamination. This zone has the next highest inhalation hazard, but does not pose a high probability of skin contact. This zone shall contain the equipment decontamination facility, and areas designated for personnel decontamination, and emergency equipment.
 - (3) Support zones shall include the remaining areas of the job site. This zone shall contain the change and shower rooms, lunch and break areas, operation direction, and support facilities (including supplies, equipment storage, and maintenance areas). No equipment or personnel shall enter the Support Zone from the Exclusion Zone without passing through the personnel or equipment Decontamination Zone. Eating, smoking, etc., shall be allowed only in this zone.

The Contractor shall ensure each worker has the proper personal protective equipment for the zone and location in which he/she is to perform construction or materials management activities. The Contractor shall be responsible for providing all personal protective equipment required by the Department and Contractor personnel. The Contractor shall define the provisions for personal protective equipment in the Site Health and Safety Plan.

The Contractor through the Site Health and Safety Plan shall determine the appropriate level of protection. The Contractor shall ensure the appropriate protective equipment is being used during activities in the Exclusion Zone and Decontamination Zone. The Contractor shall notify the Engineer of any variations from the defined levels of protection as stipulated in the Contractor's Health and Safety Plan in writing before implementation of the modifications.

- (b) Decontamination. All personnel shall go through decontamination who have participated in construction or soil management activities within the Exclusion Zone. In addition, the Contractor shall perform a wet and/or dry decontamination process on excavation and construction equipment as

specified when equipment is in contact with contaminated material. No equipment or vehicle shall track visible material from a contaminated facility.

(1) Personnel Decontamination. All outer protective clothing used by personnel who contact contaminated material while in the Exclusion Zone shall be collected in plastic bags and placed in leak-proof sealable containers, such as 208 L (55 gal) open-top drums. The Contractor shall transport all containers to a secure staging area for temporary storage. The Contractor shall inform the Engineer of the time and manner of disposal of containers containing contaminated protective clothing. The Contractor shall be responsible for transporting and disposing of the containers. The Contractor shall be responsible for ensuring the personnel decontamination portion of this zone contains clean, unused 150 micron (6 mil) polyethylene sheeting.

(2) Equipment Decontamination.

- a. Dry Decontamination. The Contractor shall perform dry decontamination on equipment that has contacted material classified as a non-special waste, special waste, or hazardous waste before moving that equipment to any other location, whether the new location is contaminated or uncontaminated. Dry equipment decontamination shall consist of the removal of all visible material from excavation and construction equipment parts, such as shovels, wheel tracks, and buckets. During dry decontamination, the Contractor shall ensure that removed contaminated material does not contact the ground surface. The Contractor shall place all contaminated material removed during dry decontamination with contaminated material of similar classification and dispose of with other excavated material from that facility location.
- b. Wet Decontamination. The Contractor shall perform the wet decontamination process when construction/soil management activities associated with non-special waste, special waste, or hazardous waste are followed by construction/soil management activities associated with uncontaminated excavation or fill material. If the Engineer observes residual and/or nonspecial waste, special waste, or hazardous waste material during the initial (or subsequent) inspection of equipment, the Engineer will require the Contractor to perform either wet and/or dry decontamination before approving equipment for use at another location. Before departure from the project area, all equipment and vehicles contacting contaminated material shall be wet decontaminated by the Contractor.

Personnel shall perform all wet equipment decontamination within the Decontamination Zone on equipment decontamination pad(s). The Contractor shall be responsible for the construction and maintenance of the decontamination pad(s) and for all equipment, materials, and personnel. The pad(s) shall be designed to prevent loss of decontamination liquids to the surrounding environment

through vertical infiltration and/or surface runoff from any part of the pad(s).

The Contractor shall place all removed wastes from the decontamination pad(s) in leak-proof containers and store temporarily in a secure staging area. The Contractor shall containerize the solids separate from the liquids. The Contractor shall be responsible for the transport and disposal of all waste generated from the decontamination process.

- (c) Medical Exams. The Contractor shall certify that all personnel in his/her work force who shall be working in an Exclusion or Decontamination area, have received and passed a current medical examination as required under applicable federal, state and/or local standards.
- (d) Health and Safety Training. The Contractor shall certify that all personnel within his/her work force who shall be working within an Exclusion or Decontamination area successfully complete a 40-hour Health and Safety Training Course pursuant to applicable federal, state and/or local standards, including OSHA requirements under 29 CFR 1910.120. All Contractor supervisors and craft foremen shall have successfully completed an additional eight hour Supervisor Training Course pursuant to applicable federal, state and/or local standards, including OSHA requirements under 29 CFR 1910.120.

669.07 Site Contamination Erosion Control Plan. The Contractor shall prevent stormwater from Support Zones from running into excavated contaminated areas. The Contractor shall divert all stormwater away from the Exclusion and Decontamination areas using appropriate stormwater and erosion control methods. Failure to use appropriate measures to divert stormwater will subject the Contractor to removing and properly containing the water at their own expense. The Contractor shall provide pumps and collect standing water from the excavation before continuing removal activities or other construction activities. The Contractor shall collect the removed water, place it in leak-proof storage containers, and store it in a secure staging area for future testing by the Contractor. The Contractor shall ensure the storage containers have access points to facilitate sampling. The Contractor shall inform the Engineer concerning management and disposal requirements for the water following the evaluation of the analytical results.

The Contractor shall control and minimize the release of dust during non-special waste, special waste, or hazardous waste removal activities. The Contractor may use water or acceptable chemicals to control dust emissions. The Contractor shall submit, in writing or include within the Site Contamination Operation Plan, a description of intended dust control measures to the Department for approval at least two weeks before commencement of soil excavation/construction activities.

669.08 Contaminated Soil and/or Groundwater Monitoring. The Contractor shall hire a qualified environmental firm to monitor the area containing the regulated substances. The affected area shall be monitored with a PID or FID field screen. A field screen reading of more than ten meter units (non-methane) above background indicates the potential presence of contaminated material requiring handling as a non-special waste, special waste, or hazardous waste. The PID or FID meter shall

be calibrated on site and background level readings taken and recorded daily. All testing shall be done by a qualified engineer/technician. Such testing and monitoring shall be included in the work. The Contractor shall identify the exact limits of removal of non-special waste, special waste, or hazardous waste. All limits shall be approved by the Engineer prior to excavation. The Contractor shall take all necessary precautions.

Based upon PID or FID readings indicating contamination, a soil or groundwater sample shall be taken from the same location and submitted to an approved laboratory. Soil or groundwater samples shall be analyzed for the contaminants of concern based on the property's land use history. The analytical results shall serve to document the level of soil contamination. When the analytical results indicate detected levels are at or below the most stringent Tier 1 Soil Remediation Objectives for Residential Properties presented in Appendix B Table A of 35 Illinois Administrative Code 742 (IAC), the soil excavated shall be included in the storm sewer or earth excavation, as appropriate, and backfill shall be according to Section 205 and/or 208. When the analytical results indicate detected levels are above the most stringent Tier 1 Soil Remediation Objectives for Residential Properties presented in Appendix B, Table A of 35 IAC 742, the soil excavated shall be considered a waste and managed as stated. When groundwater analytical results indicate the detected levels are above Appendix B, Table E of 35 IAC 742, the most stringent Tier 1 Groundwater Remediation Objectives for Groundwater Component of the Groundwater Ingestion Route for Class 1 groundwater, the groundwater shall be managed off-site as a special waste. Soil and groundwater samples may be required at the discretion of the Engineer to verify the level of soil and groundwater contamination.

Samples shall be grab samples (not combined with other locations). The samples shall be taken with disposable instruments. The samples shall be placed in sealed containers and transported in an insulated container to the laboratory. The container shall maintain a temperature of 4 °C (39 °F). All samples shall be clearly labeled. The labels shall indicate the sample number, date sampled, location and elevation, and any other observations.

The laboratory shall use a detectable concentration which is equal to the lowest appropriate practical quantitation limits (PQL) or estimated quantitation limit (EQL) specified in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA Publication No. SW-846 and "Methods for the Determination of Organic Compounds in Drinking Water", EPA, EMSL, EPA-600/4-88/039. For parameters where the specified cleanup objective is below the acceptable detection limit (ADL), the ADL shall serve as the cleanup objective. For other parameters the ADL shall be equal to or below the specified cleanup objective.

669.09 Contaminated Soil and/or Groundwater Management and Disposal. Soil and/or concrete removed from an excavation which is determined by the Engineer to be contaminated, will not be placed in the excavation. All groundwater encountered within lateral trenches may be managed within the trench and allowed to infiltrate back into the ground. If the groundwater cannot be managed within the trench it must be removed as a special or hazardous waste. The Contractor is prohibited from managing groundwater within the trench by discharging it through any existing or new storm sewer. The Contractor shall install backfill plug within the area of groundwater contamination.

One backfill plug shall be placed down gradient to the area of groundwater contamination. The backfill plugs shall be installed at intervals not to exceed 15 m (50 ft). Backfill plugs are to be 1.2 m (4 ft) long, measured parallel to the trench, full trench width and depth. Backfill plugs shall not have any fine aggregate bedding or backfill, but shall be entirely cohesive soil, concrete, or equivalent material approved by the Engineer. The backfill plugs shall have a permeability of less than 10^{-7} cm/sec.

The Contractor shall use due care when transferring contaminated material from the area of origin to the transporter. Should releases of contaminated material to the environment occur that are visible (i.e., spillage onto the ground, etc.), the Contractor shall clean-up spilled material and place in the appropriate storage containers as previously specified. Clean-up shall include, but not be limited to, sampling beneath the material staging area to determine complete removal of the spilled material.

The Contractor shall be responsible for transporting and disposing all material classified as a non-special waste, special waste, or hazardous waste from the job site to an appropriately permitted landfill facility. The transporter and the vehicles used for transportation shall comply with all federal, state, and local rules and regulations governing the transportation of non-special waste, special waste, or hazardous waste.

The Contractor shall line all equipment used by the Contractor to haul contaminated material to the landfill facility with a 150 micron (6 mil) polyethylene liner and provide secure cover during transportation. The Contractor shall obtain all documentation including any permits and/or licenses required to transport the contaminated material to the disposal facility.

The Engineer shall coordinate with the Contractor on the completion of all documentation. The Contractor shall make all arrangements for testing and waste disposal approval with the disposal facility. Subsequent to the Contractor completing these activities and upon receipt of authorization from the Engineer, the Contractor shall initiate the disposal process.

The Contractor shall provide the Engineer with all transport-related documentation within two days of transport or receipt of said document(s). The Engineer shall maintain the file for all such documentation. For management of special or hazardous waste, the Contractor shall provide the Engineer with documentation the Contractor (or subcontractor, if a subcontractor is used for transportation) is operating with a valid Illinois special waste transporter permit at least two weeks before transporting the first load of contaminated material.

The Contractor shall schedule and arrange the transport and disposal of each load of contaminated material produced. The Contractor shall make all transport and disposal arrangements to ensure no contaminated material remains within the project area at the close of business each day. Exceptions to this specification require prior approval from the Engineer within 24 hours of close of business. The Contractor shall be responsible for all other pre-disposal/transport preparations necessary on a daily basis to accomplish management activities.

Any waste generated as a special or hazardous waste from a non-fixed facility shall be manifested off-site using the Department's county generator number. An authorized representative of the Department shall sign all manifests for the disposal of the contaminated material and confirm the Contractor's transported volume. Any waste generated as a non-special waste may be managed off-site without a manifest, a special waste transporter, and a generator number.

The Contractor may select a landfill mandated by definition of the contaminant within the State of Illinois. The Department reserves the right to review and to accept or reject the facility proposed by the Contractor to use as a landfill. The Contractor shall verify whether the selected disposal facility is in compliance with those applicable standards as mandated by definition of the contaminant and whether the disposal facility is presently, has previously been, or has never been, on the United States Environmental Protection Agency (U.S. EPA) National Priorities List or the Resource Conservation and Recovery Act (RCRA) List of Violating Facilities. The Contractor shall be responsible for coordinating permits with the IEPA. The use of a Contractor selected landfill shall in no manner delay the construction schedule or alter the Contractor's responsibilities as set forth.

The disposal of all materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., in undesignated areas within the project will not be permitted. The Contractor shall remove the waste material placed in authorized areas and restore the area to its original condition. The Contractor shall excavate and dispose of as directed by the Engineer, at the Contractor's expense any project area soils affected by the Contractor's unauthorized disposal actions.

669.10 Non-Special Waste Certification. An authorized representative of the Department shall sign and date all non-special waste certifications. The Contractor shall be responsible for providing the Engineer with the required information that will allow the Engineer to certify the waste is not a special waste.

(a) Definition. A waste is considered a non-special waste as long as it is not:

- (1) a potentially infectious medical waste;
- (2) a hazardous waste as defined in 35 IAC 721;
- (3) an industrial process waste or pollution control waste that contains liquids, as determined using the paint filter test set forth in subdivision (3)(A) of subsection (m) of 35 IAC 811.107;
- (4) a regulated asbestos-containing waste material, as defined under the National Emission Standards for Hazardous Air Pollutants in 40 CFR 61.141;
- (5) a material containing polychlorinated biphenyls (PCB's) regulated pursuant to 40 CFR Part 761;
- (6) a material subject to the waste analysis and recordkeeping requirements of 35 IAC 728.107 under land disposal restrictions of 35 IAC 728;

- (7) a waste material generated by processing recyclable metals by shredding and required to be managed as a special waste under Section 22.29 of the Environmental Protection Act; or
- (8) an empty portable device or container in which a special or hazardous waste has been stored, transported, treated, disposed of, or otherwise handled.

(b) Certification Information.

All information used to determine the waste is not a special waste shall be attached to the certification. The information shall include but not be limited to:

- (1) the means by which the generator has determined the waste is not a hazardous waste;
- (2) the means by which the generator has determined the waste is not a liquid;
- (3) if the waste undergoes testing, the analytic results obtained from testing, signed and dated by the person responsible for completing the analysis;
- (4) if the waste does not undergo testing, an explanation as to why no testing is needed;
- (5) a description of the process generating the waste; and
- (6) relevant material data safety sheets.

669.11 Temporary Staging. The Contractor shall excavate and dispose of all waste material as mandated by the contaminates without temporary staging. If circumstances require the Contractor to use temporary staging, he/she shall request, in writing, approval from the Engineer.

When approved, the Contractor shall prepare a secure location within the project area capable of housing containerized waste materials. The Contractor shall contain all waste material in leak-proof storage containers such as lined roll-off boxes or 208 L (55 gal) drums, or stored in bulk fashion on storage pads. The design and construction of such storage pad(s) for bulk materials shall be subject to approval by the Engineer. The Contractor shall place the staged storage containers on an all-weather gravel-packed, asphalt, or concrete surface. The Contractor shall maintain a clearance both above and beside the storage units to provide maneuverability during loading and unloading. The Contractor shall provide any assistance or equipment requested by the Engineer for authorized personnel to inspect and/or sample contents of each storage container. All containers and their contents shall remain intact and undisturbed by unauthorized persons until the manner of disposal is determined. The Contractor shall keep the storage containers covered except when access is requested by authorized personnel of the Department. The Engineer shall authorize any additional material added to the contents of any storage container before being filled.

The Contractor shall ensure the staging area is enclosed (by a fence or other structure) to ensure direct access to the area is restricted, and he/she shall procure and place all required regulatory identification signs applicable to an area containing the waste material. The Contractor shall be responsible for all activities associated with the storage containers including, but not limited to, the procurement, transport, and labeling of the containers. The Contractor shall clearly mark all containers in permanent marker or paint with the date of waste generation, location and/or area of waste generation, and type of waste (e.g., decontamination water, contaminated clothing, etc.). The Contractor shall place these identifying markings on an exterior side surface of the container. The Contractor shall separately containerize each contaminated medium, i.e. contaminated clothing is placed in a separate container from decontamination water. Containers used to store liquids shall not be filled in excess of 80 percent of the rated capacity. The Contractor shall not use a storage container if visual inspection of the container reveals the presence of free liquids or other substances that could classify the material as a hazardous waste in the container.

The Department will not be responsible for any additional costs incurred, if mismanagement of the staging area, storage containers, or their contents by the Contractor results in excess cost expenditure for disposal or other material management requirements.

669.12 Underground Storage Tank Removal. Prior to removing an UST the Engineer shall determine whether the Department is considered an "owner" or "operator" of the UST as defined by the UST regulations. Ownership of the UST refers to the Department's owning title to the UST during storage, use or dispensing of regulated substances. The Department may be considered an "operator" of the UST if it has control of, or has responsibility for, the daily operation of the UST. The Department may however voluntarily undertake actions to remove an UST from the ground without being deemed an "operator" of the UST.

In the event the Department is deemed not to be the "owner" or "operator" of the UST, the OSFM pull permit shall reflect who was the past "owner" or "operator" of the UST. If the "owner" or "operator" cannot be determined from past UST registration documents from OSFM then the OSFM pull permit will state the "owner" or "operator" of the UST is unknown. The Department's Chief Counsel's Office will review all UST pull permits, prior to submitting any pull permit to the OSFM. No UST removal shall be done without notifying the District's Environmental Coordinator, obtaining a pull permit, and the presence of a representative of OSFM on-site during the UST pull. If the Department is not the "owner" or "operator" of the UST then it will not register the UST or pay any registration fee.

The Contractor shall take soil samples from the bottom and walls of the excavated area after all soil has been removed during the initial response action, to determine the level of contamination remaining in the ground. The Contractor shall be responsible for obtaining all permits required for pulling the UST, all notification to the OSFM, removing the UST with properly trained personnel, and removing and disposing of the tank and its contents.

In the event the UST is designated a leaking underground storage tank (LUST) by the OSFM's inspector, the Contractor shall notify the Engineer. Upon confirmation

of a release of contaminants from the UST the Contractor shall perform the following initial response actions:

- (a) Report the release to the Illinois Emergency Management Agency (IEMA) (e.g., by telephone or electronic mail) and provide them with whatever information is available ("owner" or "operator" shall be stated as the past registered "owner" or "operator", unknown, or the Department);
- (b) Take immediate action to prevent any further release of the regulated substance to the environment, which may include removing, at the Engineer's discretion, and disposing of 1.2 m (4 ft) of the backfill surrounding the LUST;
- (c) Identify and mitigate fire, explosion and vapor hazards;
- (d) Remove as much of the regulated substance from the UST system as necessary to prevent further release into the environment;
- (e) Visually inspect any above ground releases or exposed below ground releases and prevent further migration of the released substance into surrounding soils and groundwater; and
- (f) Continue to monitor and mitigate any additional fire and safety hazards posed by vapors and free product that have migrated from the UST excavation zone and entered into subsurface structures (such as sewers or basements).

All contents within the tank shall be removed, transported and disposed of, or recycled. The tank shall be removed and rendered empty according to IEPA definition. This work shall include all required documentation, according to State, Federal and Local regulations and laws.

All uncontaminated concrete and soil removed during tank extraction may be used to backfill the excavation, at the discretion of the Engineer.

669.13 Underground Storage Tank Backfill. The Contractor shall furnish a cohesive soil for backfilling areas where an underground storage tank removal has occurred. Cohesive soil shall contain less than ten percent sand or larger grain-size particles, having at least 25 percent clay, and a plastic index greater than 15. Cohesive backfill will not be required to backfill the sewer trenches and appurtenances constructed or any areas beneath pavement where an underground storage tank removal has occurred.

After backfilling the excavation, the site shall be graded and cleaned to the satisfaction of the Engineer. This work shall be done according to the applicable portions of Section 205, 208, and 550.

669.14 Project Reports.

- (a) Interim Reports. The Contractor shall be responsible for submitting three copies of a report to the Engineer on a monthly or quarterly basis regarding the management and/or monitoring of non-special waste, special waste, or

hazardous waste. The reports shall include all pertinent information regarding the project including, but not limited to:

- (1) The main issues during the reporting period,
 - (2) Activities/progress during the period,
 - (3) Major deliverables/submittals,
 - (4) Upcoming events/anticipated activities next period,
 - (5) Key personnel changes, and
 - (6) Subcontracting.
- (b) Final Reports. At the end of the project, the Contractor will prepare a technical report on the activities conducted during the life of the project and submit three copies to the Engineer. One additional copy of the technical report shall be sent to the District's Environmental Studies Unit and one additional copy of the technical report shall be sent to the Geologic and Waste Assessment Unit, Bureau of Design and Environment, IDOT, 2300 South Dirksen Parkway, Springfield, Illinois 62764. All project records shall be submitted to the Engineer. The technical report shall include all pertinent information regarding the project including, but not limited to:
- (1) Measures taken to identify, monitor, handle, and dispose of contaminated soil or groundwater, to prevent further migration of contaminants and to protect workers,
 - (2) Cost of identifying, monitoring, handling, and disposing of contaminated soil or groundwater, the cost of preventing further migration of contaminants and the cost for worker protection.
 - (3) Plans showing the areas of contamination,
 - (4) Field sampling and testing results,
 - (5) Hourly records of Contractors and subcontractors broken down by site,
 - (6) Waste manifests (identified by site) for special or hazardous waste disposal, and
 - (7) Landfill tickets (identified by site) for non-special waste disposal.

669.15 Method of Measurement. Non-special waste, special waste, or hazardous waste soil disposal shall be measured for payment according to Articles 502.14 and 202.07(b) except the quantity for which payment will be made will not exceed the volume of the trench, as computed by using the maximum width of trench permitted by the Specifications and the actual depth of the trench, with a deduction for the volume of the pipe.

Groundwater disposal will be measured for payment in liters (gallons).

Backfill plugs will be measured in cubic meters (cubic yards) in place except the quantity for which payment will be made shall not exceed the volume of the trench, as computed by using the maximum width of trench permitted by the Specifications and the actual depth of the trench, with a deduction for the volume of the pipe.

669.16 Basis of Payment. Underground storage tank removal, soil excavation, soil and content sampling, and the excavated soil and UST disposal will be paid for at the contract unit price each for UNDERGROUND STORAGE TANK REMOVAL.

The disposal of soil and/or concrete from an excavation determined to be contaminated shall be paid for at the contract unit price per cubic meter (cubic yard) for NON-SPECIAL WASTE DISPOSAL, SPECIAL WASTE DISPOSAL or HAZARDOUS WASTE DISPOSAL.

The disposal of groundwater from an excavation determined to be contaminated will be paid for at the contract unit price per liter (gallon) for SPECIAL WASTE GROUNDWATER DISPOSAL or HAZARDOUS WASTE GROUNDWATER DISPOSAL.

The preparation, administration and execution of the Site Safety and Health Plan, Site Contamination Operation Plan, Erosion Control Plan, and Reports will be paid for at the lump sum price for SPECIAL WASTE PLANS AND REPORTS.

When the contaminants of concern are gasoline only, soil or groundwater samples shall be analyzed for benzene, ethylbenzene, toluene, and xylenes (BETX). The analysis will be paid for at the contract unit price each for BETX SOIL ANALYSIS and/or BETX GROUNDWATER ANALYSIS using EPA Method 8021B. This price shall include transporting the sample from the job site to the laboratory.

When the contaminants of concern are middle distillate and heavy ends, soil or groundwater samples shall be analyzed for BETX and polynuclear aromatics (PNAS). The analysis will be paid for at the contract unit price each for BETX-PNAS SOIL ANALYSIS and/or BETX-PNAS GROUNDWATER ANALYSIS using EPA Method 8021B for BETX and EPA Method 8310 for PNAS. This price shall include transporting the sample from the job site to the laboratory.

When the contaminants of concern are used oils, soil samples shall be analyzed for priority pollutant volatile organic compounds (VOCs), priority, pollutants semi-volatile organic compounds (SVOCS), and priority pollutants metals. The analysis will be paid for at the contract unit price each for PRIORITY POLLUTANT SOIL ANALYSIS using EPA Method 8260B for VOCs, EPA Method 8270C for SVOCS, and using an ICP instrument and EPA Methods 6010B and 7471A for metals. This price shall include transporting the sample from the job site to the laboratory.

When the contaminants of concern are unknowns or non-petroleum material, soil samples shall be analyzed for priority pollutant VOCs, SVOCS, priority pollutants metals, and RCRA metals by TCLP. The analysis will be paid for at the contract unit price each for PRIORITY POLLUTANT-TCLP SOIL ANALYSIS using EPA Method 8260B for VOCs, EPA Method 8270C for SVOCS, and ICP instrument and EPA

Methods 6010B, 7471A, 1311 (extraction), 6010B, and 7470A for metals. This price shall include transporting the sample from the job site to the laboratory.

When the waste material for disposal require sampling for disposal acceptance, the samples shall be analyzed for TCLP VOCs, SVOCs, RCRA metals, pH, flash point, and paint filter. The analysis will be paid for at the contract unit price each for SOIL DISPOSAL ANALYSIS using EPA Methods 1311 (extraction), 8260B for VOCs, 8270C for SVOCs, 6010B and 7470A for RCRA metals, 9045C for pH, 1030 for flash point, and 9095A for paint filter. This price shall include transporting the sample from the job site to the laboratory.

When the contaminants of concern are used oils, non-petroleum material, or unknowns, groundwater samples shall be analyzed priority pollutant volatile organics compounds (VOCs), priority pollutants semi-volatile organics compounds (SVOCs), and priority pollutants metals. The analysis will be paid for at the contract unit price each for PRIORITY POLLUTANT GROUNDWATER ANALYSIS using EPA Method 8260B for VOCs, EPA Method 8270C for SVOCs, and EPA Methods 6010B and 7470A for metals. This price shall include transporting the sample from the job site to the laboratory.

Backfill plugs will be paid for at the contract unit price per cubic meter (cubic yard) for BACKFILL PLUGS.

Payment for temporary staging, if required, will be paid for according to Article 109.04.

Payment for accumulated stormwater removal and disposal will be according to Article 109.04. Payment will only be allowed if appropriate stormwater and erosion control methods were used.

Payment for decontamination, labor, material, and equipment for monitoring areas beyond the specified areas, with the Engineer's prior written approval, will be according to Article 109.04.

SECTION 670. ENGINEERS FIELD OFFICE AND LABORATORY

670.01 Description. This item shall consist of furnishing and maintaining in good condition for the exclusive use of the Engineer a weatherproof building or buildings hereinafter described at locations approved by the Engineer. Unless otherwise provided, the building shall be independent of any building used by the Contractor and all keys to the buildings shall be turned over to the Engineer. The Engineer will designate the location of the building and it shall remain on the work site until released by the Engineer.

Each field office or laboratory furnished shall be equipped with fire extinguishers having a minimum underwriters laboratory rating of 4A60BC.

670.02 Engineer's Field Office Type A. Type A field offices shall have a ceiling height of not less than 2 m (7 ft) and a floor space of not less than 35 sq m (380 sq ft). The office shall be provided with sufficient heat, natural and artificial light,

and air conditioning. Doors and windows shall be equipped with locks approved by the Engineer.

Windows shall be equipped with exterior screens to allow adequate ventilation. All windows shall be equipped with interior shades, curtains or blinds. Adequate all-weather parking space shall be available to accommodate a minimum of ten vehicles.

Suitable on-site sanitary facilities meeting Federal, State and local health department requirements shall be provided and maintained clean and in good working condition and shall be stocked with lavatory and sanitary supplies at all times during the period of the contract.

Sanitary facilities shall include hot and cold potable running water, lavatory and toilet as an integral part of the office where available. Solid waste disposal consisting of two waste baskets and an outside trash container of sufficient size to accommodate a weekly provided pick-up service.

An electronic security system that will respond to any breach of exterior doors and windows with an on-site alarm will be provided.

In addition, the following equipment and furniture meeting the approval of the Engineer shall be furnished:

- (a) Four desks with minimum working surface 1.1 m x 750 mm (42 in. x 30 in.) each and five non-folding chairs with upholstered seats and backs.
- (b) One desk with minimum working surface 1.1 m x 750 mm (42 in. x 30 in.) with height adjustment of 585 to 750 mm (23 in. to 30 in.) for computer use.
- (c) One four-post drafting table with minimum top size of 950 mm x 1.2 m (37 1/2 in. x 48 in.). The top shall be basswood or equivalent and capable of being tilted through an angle of 50 degrees. An adjustable height drafting stool with upholstered seat and back shall also be provided.
- (d) One free standing four drawer legal size file cabinet with lock and an underwriters' laboratories insulated file device 350 degrees one hour rating.
- (e) Four folding chairs.
- (f) One equipment cabinet of minimum inside dimension of 1100 mm (44 in.) high x 600 mm (24 in.) wide x 750 mm (30 in.) deep with lock. The walls shall be of steel with a 2 mm (3/32 in.) minimum thickness with concealed hinges and enclosed lock constructed in such a manner as to prevent entry by force. The cabinet assembly shall be permanently attached to a structural element of the field office in a manner to prevent theft of the entire cabinet.
- (g) One office style refrigerator with a minimum size of 0.2 cu m (8 cu ft) with a freezer unit.
- (h) One electric desk type tape printing calculator and one pocket scientific notation calculator with a 1000 hour battery life or with a portable recharger.

- (i) One telephone, with touch tone, where available, and telephone answering machine, for exclusive use by the Engineer. Two additional separate telephone lines, without telephones, shall be provided for the exclusive use of the Engineer.
- (j) One dry process copy machine capable of reproducing prints up to legal size [215 mm x 355 mm (8 1/2 in. x 14 in.)] from nontransparent master sheets, as black or blue lines on white paper, including maintenance, reproduction paper, activating agent and power source.
- (k) One fax machine with paper.
- (l) One electric water cooler dispenser.
- (m) One first-aid cabinet fully equipped.

670.03 Reserved.

670.04 Engineer's Field Office Type B. Type B field offices shall have a ceiling height of not less than 2 m (7 ft) and a floor space of not less than 11 sq m (120 sq ft). The office shall be provided with sufficient heat, natural and artificial light, and air conditioning. Doors and windows shall be equipped with locks approved by the Engineer.

In addition, the following equipment and furniture meeting the approval of the Engineer shall be furnished:

- (a) One desk with minimum working surface 1.1 m x 750 mm (42 in. x 30 in.) each and one non-folding chair with upholstered seat and back.
- (b) One file cabinet, letter size, two drawer.
- (c) One four-post drafting table with minimum top size of 950 mm x 1.2 m (37 1/2 in. x 48 in.). The top shall be basswood or equivalent and capable of being tilted through an angle of 50 degrees. An adjustable height drafting stool with upholstered seat and back shall also be provided.
- (d) One equipment cabinet of minimum inside dimension of 1100 mm (44 in.) high x 600 mm (24 in.) wide x 750 mm (30 in.) deep with lock. The walls shall be of steel with a 2 mm (3/32 in.) minimum thickness with concealed hinges and enclosed lock constructed to prevent entry by force. The cabinet assembly shall be permanently attached to a structural element of the field office to prevent theft of the entire cabinet.
- (e) One telephone, with touch tone, where available, and a digital telephone answering machine, for exclusive use by the Engineer. Two additional separate telephone lines, without telephones, shall be provided for the exclusive use of the Engineer).
- (f) One electric desk type calculator and one adding machine with tape or one tape printing calculator.

- (g) One first-aid cabinet fully equipped.
- (h) One dry process copy machine capable of reproducing prints up to legal size [215 mm X 355 mm (8 1/2 in. X 14 in.)] from nontransparent master sheets, as black or blue lines on white paper, including maintenance, reproduction paper, activating agent and power source.
- (i) One fax machine with paper.
- (j) A portable toilet meeting Federal, State and Local health Department requirements.
- (k) One electric water cooler dispenser.

670.05 Engineer's Field Laboratory. The field laboratory shall have a ceiling height of not less than 2 m (7 ft) and a floor space of not less than 18.5 sq m (200 sq ft). The laboratory shall be provided with sufficient heat, natural and artificial light and air conditioning. Sanitary facilities as specified for Engineer's Field Office Type A shall also be included. Doors and windows shall be equipped with locks approved by the Engineer.

In addition, the following equipment and furniture meeting the approval of the Engineer shall be furnished:

- (a) One desk and chair
- (b) One drafting stool
- (c) One chair
- (d) One file cabinet, letter size, two drawer
- (e) One electric calculator
- (f) One telephone (for exclusive use by the Engineer)
- (g) One first-aid cabinet fully equipped
- (h) One service sink and water supply for testing purposes
- (i) One work bench 900 mm x 3 m x 900 mm (3 ft x 10 ft x 36 in.) high with drawers and cabinets below and three 110 volt, 20 amp outlets above the bench.

670.06 Mobile Units. With the approval of the Engineer, a mobile unit or units of approximately the same dimensions and having similar facilities may be substituted for the above described building or buildings.

All mobile field offices and laboratories shall be tied down near the four corners at each end of the mobile unit. The tie-down equipment shall be of the type commonly sold by mobile home equipment suppliers to protect mobile homes in

areas affected by hurricanes. The tie-down shall be made to the satisfaction of the Engineer.

The mobile unit shall be securely supported by adequate blocking. The blocking shall provide a foundation to prevent settlement.

A landing of minimum 1 m x 1 m (3 ft x 3 ft) dimension shall be provided at each doorway with integral steps and railings.

670.07 Basis of Payment. The building or buildings fully equipped as specified, once accepted by the Engineer, will be paid for on a monthly basis until the building or buildings are released by the Engineer. The Contractor will be paid the contract bid price each month provided the building or buildings are maintained, equipped and utilities furnished. Payment will not be made when the contract is suspended according to Article 108.07 for failure of the Contractor to comply with the provisions of the contract. The building or buildings fully equipped, will be paid for at the contract unit price per calendar month or fraction thereof for ENGINEER'S FIELD OFFICE TYPE A, ENGINEER'S FIELD OFFICE TYPE B or ENGINEER'S FIELD LABORATORY. This price shall include all utility costs and shall reflect the salvage value of the building or buildings, equipment, and furniture which becomes the property of the Contractor after release by the Engineer, except that the Department will pay that portion of each monthly long distance telephone bill in excess of \$50.

Any extraordinary damage attributed to State operations during the course of the job will be repaired by the Contractor and may be paid for according to Article 109.04. No extra payment will be made for systems maintenance, repairs or replacement, or for damages incurred as a result of vandalism, theft or other criminal activities.

SECTION 671. MOBILIZATION

671.01 Description. This work shall consist of preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of offices, buildings and other facilities necessary for work on the projects; and for all other work or operations which must be performed or costs incurred when beginning work on the project.

671.02 Basis of Payment. Upon execution of the contract, three percent of the total contract bid will be paid as the original mobilization payment.

The three percent will be recovered according to the following schedule.

- (a) When ten percent or more of the original contract amount is earned, 1/5 of the original mobilization payment will be deducted from the current pay voucher.
- (b) When 20 percent or more of the original contract amount is earned, a cumulative 2/5 of the original mobilization payment will be deducted from the current pay voucher.

- (c) When 30 percent or more of the original contract amount is earned, a cumulative $\frac{3}{5}$ of the original mobilization payment will be deducted from the current pay voucher.
- (d) When 40 percent or more of the original contract amount is earned, a cumulative $\frac{4}{5}$ of the original mobilization payment will be deducted from the current pay voucher.
- (e) When 50 percent or more of the original contract amount is earned, the remaining balance of the original mobilization payment will be deducted from the current pay voucher.